Tuning

Getting Parameters

```
library(mlr)
```

```
## Loading required package: ParamHelpers
```

```
lrn = makeLearner("classif.rpart")
getParamSet(lrn)
```

```
##                     Type len  Def   Constr Req Tunable Trafo
## minsplit         integer   -   20 1 to Inf   -    TRUE     -
## minbucket        integer   -    - 1 to Inf   -    TRUE     -
## cp               numeric   - 0.01   0 to 1   -    TRUE     -
## maxcompete       integer   -    4 0 to Inf   -    TRUE     -
## maxsurrogate     integer   -    5 0 to Inf   -    TRUE     -
## usesurrogate    discrete   -    2    0,1,2   -    TRUE     -
## surrogatestyle  discrete   -    0      0,1   -    TRUE     -
## maxdepth         integer   -   30  1 to 30   -    TRUE     -
## xval             integer   -   10 0 to Inf   -   FALSE     -
## parms            untyped   -    -        -   -    TRUE     -
```

Random Search

```
ps = makeParamSet(
    makeIntegerParam("minsplit", lower = 1, upper = 100),
    makeIntegerParam("maxdepth", lower = 2, upper = 30)
)
ctrl = makeTuneControlRandom(maxit = 50)
rdesc = makeResampleDesc("CV", iters = 3)
res = tuneParams(lrn, task = iris.task, resampling = rdesc, par.set = ps, control = ctrl)
```

```
## [Tune] Started tuning learner classif.rpart for parameter set:
```

```
##             Type len Def   Constr Req Tunable Trafo
## minsplit integer   -   - 1 to 100   -    TRUE     -
## maxdepth integer   -   -  2 to 30   -    TRUE     -
```

```
## With control class: TuneControlRandom
```

```
## Imputation value: 1
```

```
## [Tune-x] 1: minsplit=45; maxdepth=2
```

```
## [Tune-y] 1: mmce.test.mean=0.0533; time: 0.0 min
```

```
## [Tune-x] 2: minsplit=82; maxdepth=4
```

```
## [Tune-y] 2: mmce.test.mean=0.367; time: 0.0 min
```

```
## [Tune-x] 3: minsplit=9; maxdepth=15
```

```
## [Tune-y] 3: mmce.test.mean=0.04; time: 0.0 min
```

```
## [Tune-x] 4: minsplit=76; maxdepth=17
## [Tune-y] 4: mmce.test.mean=0.367; time: 0.0 min
## [Tune-x] 5: minsplit=74; maxdepth=2
## [Tune-y] 5: mmce.test.mean=0.367; time: 0.0 min
## [Tune-x] 6: minsplit=47; maxdepth=9
## [Tune-y] 6: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 7: minsplit=93; maxdepth=4
## [Tune-y] 7: mmce.test.mean=0.427; time: 0.0 min
## [Tune-x] 8: minsplit=37; maxdepth=17
## [Tune-y] 8: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 9: minsplit=30; maxdepth=4
## [Tune-y] 9: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 10: minsplit=39; maxdepth=3
## [Tune-y] 10: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 11: minsplit=16; maxdepth=4
## [Tune-y] 11: mmce.test.mean=0.0467; time: 0.0 min
## [Tune-x] 12: minsplit=98; maxdepth=20
## [Tune-y] 12: mmce.test.mean=0.427; time: 0.0 min
## [Tune-x] 13: minsplit=25; maxdepth=29
## [Tune-y] 13: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 14: minsplit=50; maxdepth=20
## [Tune-y] 14: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 15: minsplit=97; maxdepth=17
## [Tune-y] 15: mmce.test.mean=0.427; time: 0.0 min
## [Tune-x] 16: minsplit=34; maxdepth=11
## [Tune-y] 16: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 17: minsplit=99; maxdepth=24
## [Tune-y] 17: mmce.test.mean=0.427; time: 0.0 min
## [Tune-x] 18: minsplit=32; maxdepth=23
## [Tune-y] 18: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 19: minsplit=57; maxdepth=5
## [Tune-y] 19: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 20: minsplit=17; maxdepth=28
## [Tune-y] 20: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 21: minsplit=6; maxdepth=30
## [Tune-y] 21: mmce.test.mean=0.04; time: 0.0 min
```

```
## [Tune-x] 22: minsplit=87; maxdepth=7
## [Tune-y] 22: mmce.test.mean=0.367; time: 0.0 min
## [Tune-x] 23: minsplit=52; maxdepth=6
## [Tune-y] 23: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 24: minsplit=6; maxdepth=14
## [Tune-y] 24: mmce.test.mean=0.04; time: 0.0 min
## [Tune-x] 25: minsplit=95; maxdepth=26
## [Tune-y] 25: mmce.test.mean=0.427; time: 0.0 min
## [Tune-x] 26: minsplit=15; maxdepth=7
## [Tune-y] 26: mmce.test.mean=0.0467; time: 0.0 min
## [Tune-x] 27: minsplit=69; maxdepth=3
## [Tune-y] 27: mmce.test.mean=0.287; time: 0.0 min
## [Tune-x] 28: minsplit=50; maxdepth=18
## [Tune-y] 28: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 29: minsplit=31; maxdepth=9
## [Tune-y] 29: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 30: minsplit=75; maxdepth=5
## [Tune-y] 30: mmce.test.mean=0.367; time: 0.0 min
## [Tune-x] 31: minsplit=58; maxdepth=2
## [Tune-y] 31: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 32: minsplit=86; maxdepth=26
## [Tune-y] 32: mmce.test.mean=0.367; time: 0.0 min
## [Tune-x] 33: minsplit=89; maxdepth=17
## [Tune-y] 33: mmce.test.mean=0.427; time: 0.0 min
## [Tune-x] 34: minsplit=79; maxdepth=26
## [Tune-y] 34: mmce.test.mean=0.367; time: 0.0 min
## [Tune-x] 35: minsplit=89; maxdepth=29
## [Tune-y] 35: mmce.test.mean=0.427; time: 0.0 min
## [Tune-x] 36: minsplit=77; maxdepth=18
## [Tune-y] 36: mmce.test.mean=0.367; time: 0.0 min
## [Tune-x] 37: minsplit=31; maxdepth=28
## [Tune-y] 37: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 38: minsplit=82; maxdepth=14
## [Tune-y] 38: mmce.test.mean=0.367; time: 0.0 min
## [Tune-x] 39: minsplit=2; maxdepth=15
## [Tune-y] 39: mmce.test.mean=0.0733; time: 0.0 min
```

```
## [Tune-x] 40: minsplit=13; maxdepth=24
## [Tune-y] 40: mmce.test.mean=0.0467; time: 0.0 min
## [Tune-x] 41: minsplit=51; maxdepth=4
## [Tune-y] 41: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 42: minsplit=9; maxdepth=15
## [Tune-y] 42: mmce.test.mean=0.04; time: 0.0 min
## [Tune-x] 43: minsplit=55; maxdepth=29
## [Tune-y] 43: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 44: minsplit=63; maxdepth=12
## [Tune-y] 44: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 45: minsplit=84; maxdepth=28
## [Tune-y] 45: mmce.test.mean=0.367; time: 0.0 min
## [Tune-x] 46: minsplit=14; maxdepth=14
## [Tune-y] 46: mmce.test.mean=0.0467; time: 0.0 min
## [Tune-x] 47: minsplit=92; maxdepth=3
## [Tune-y] 47: mmce.test.mean=0.427; time: 0.0 min
## [Tune-x] 48: minsplit=46; maxdepth=3
## [Tune-y] 48: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 49: minsplit=48; maxdepth=7
## [Tune-y] 49: mmce.test.mean=0.0533; time: 0.0 min
## [Tune-x] 50: minsplit=79; maxdepth=20
## [Tune-y] 50: mmce.test.mean=0.367; time: 0.0 min
## [Tune] Result: minsplit=6; maxdepth=14 : mmce.test.mean=0.04
```

```
res
```

```
## Tune result:
## Op. pars: minsplit=6; maxdepth=14
## mmce.test.mean=0.04
```

Tuning Results

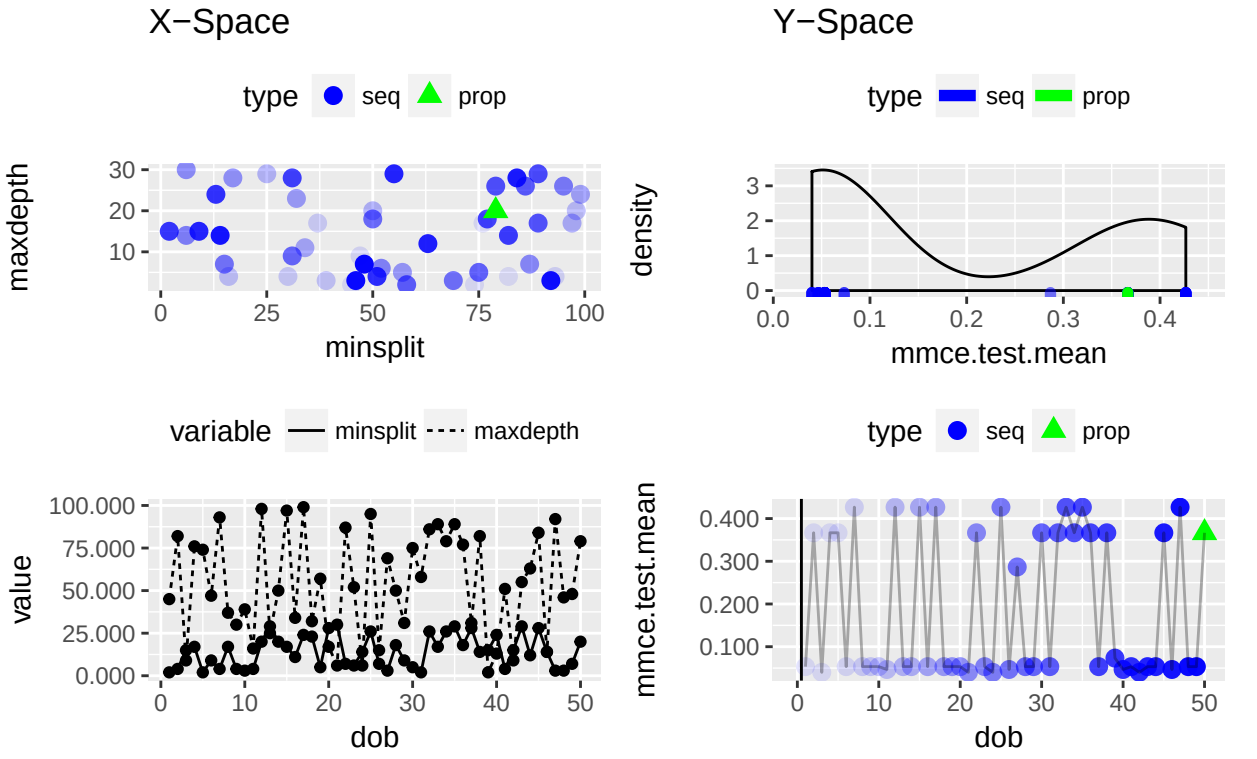
```
res$opt.path
```

```
## Optimization path
##   Dimensions: x = 2/2, y = 1
##   Length: 50
##   Add x values transformed: FALSE
##   Error messages: TRUE. Errors: 0 / 50.
##   Exec times: TRUE. Range: 0.028 - 0.154. 0 NAs.
```

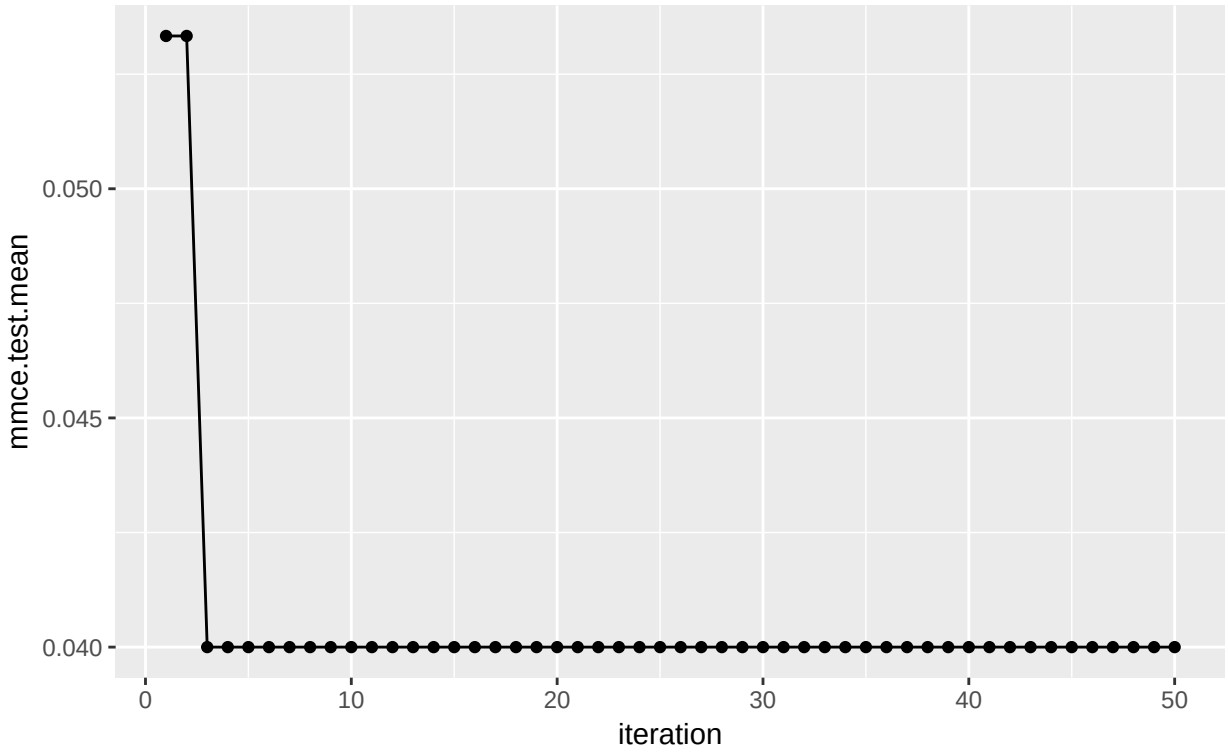
```
plotOptPath(res$opt.path)
```

```
## Loading required package: grid
```

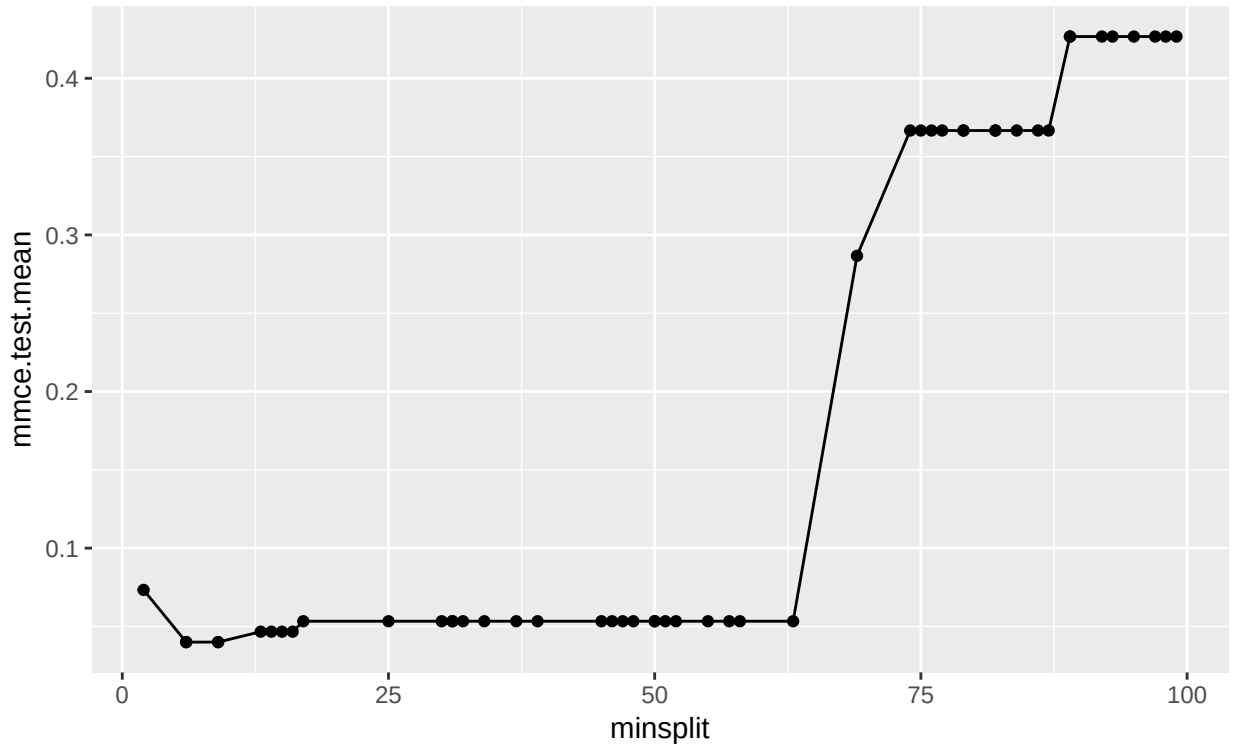
```
## Loading required package: gridExtra
```



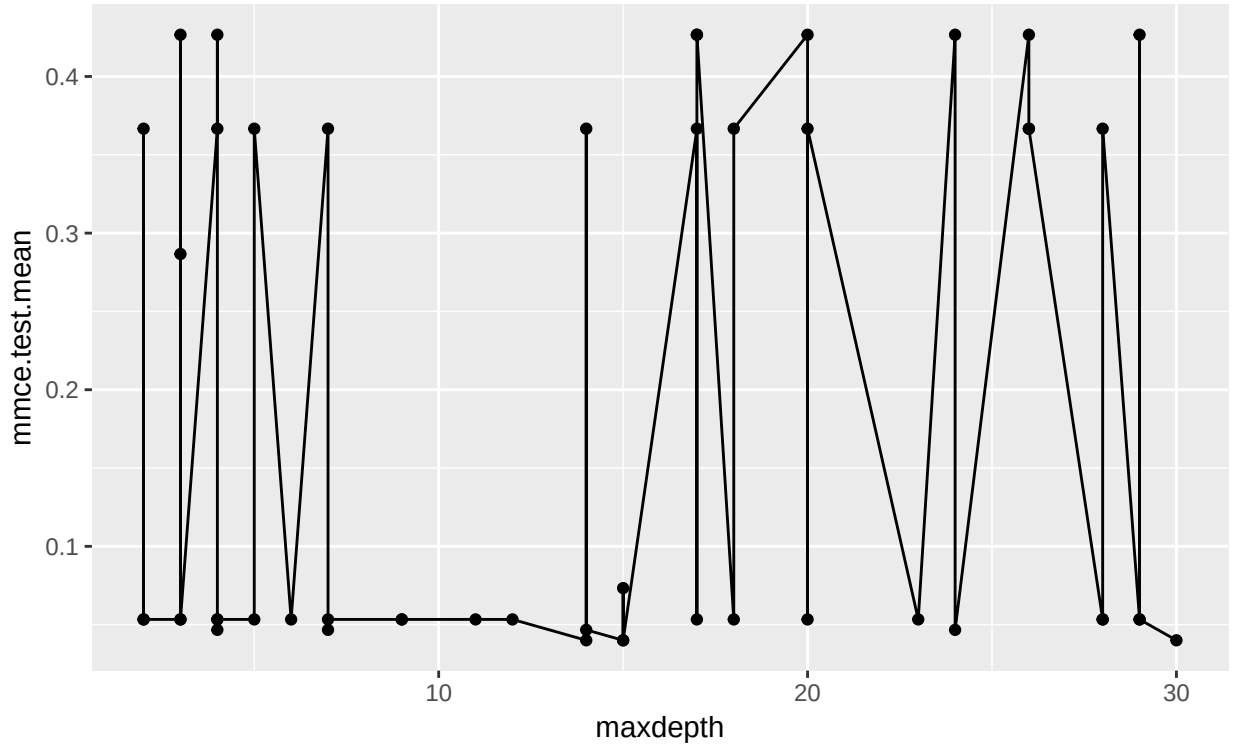

```
data = generateHyperParsEffectData(res)
plotHyperParsEffect(data, x = "iteration", y = "mmce.test.mean", plot.type = "line")
```




```
plotHyperParsEffect(data, x = "minsplit", y = "mmce.test.mean", plot.type = "line")
```




```
plotHyperParsEffect(data, x = "maxdepth", y = "mmce.test.mean", plot.type = "line")
```



Using Results

```
lrn = setHyperPars(makeLearner("classif.rpart"), par.vals = res$x)
lrn
```

```
## Learner classif.rpart from package rpart
## Type: classif
## Name: Decision Tree; Short name: rpart
## Class: classif.rpart
## Properties: twoclass,multiclass,missings,numerics,factors,ordered,prob,weights,featimp
## Predict-Type: response
## Hyperparameters: xval=0,minsplit=6,maxdepth=14
```

Wrapper and Nested Resampling

```
inner = makeResampleDesc("Subsample", iters = 2)
lrn = makeTuneWrapper("classif.rpart", resampling = inner, par.set = ps, control = ctrl)

outer = makeResampleDesc("CV", iters = 3)
res = resample(lrn, iris.task, resampling = outer, extract = getTuneResult)
```

```
## [Resample] cross-validation iter 1: [Tune] Started tuning learner classif.rpart for parameter set:
##             Type len Def   Constr Req Tunable Trafo
## minsplit integer   -   - 1 to 100   -    TRUE     -
## maxdepth integer   -   -  2 to 30   -    TRUE     -
## With control class: TuneControlRandom
## Imputation value: 1
## [Tune-x] 1: minsplit=8; maxdepth=2
## [Tune-y] 1: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 2: minsplit=29; maxdepth=30
## [Tune-y] 2: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 3: minsplit=77; maxdepth=22
## [Tune-y] 3: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 4: minsplit=96; maxdepth=21
## [Tune-y] 4: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 5: minsplit=94; maxdepth=20
## [Tune-y] 5: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 6: minsplit=37; maxdepth=4
## [Tune-y] 6: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 7: minsplit=83; maxdepth=7
## [Tune-y] 7: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 8: minsplit=25; maxdepth=19
## [Tune-y] 8: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 9: minsplit=31; maxdepth=11
## [Tune-y] 9: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 10: minsplit=95; maxdepth=5
## [Tune-y] 10: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 11: minsplit=12; maxdepth=18
## [Tune-y] 11: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 12: minsplit=60; maxdepth=28
## [Tune-y] 12: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 13: minsplit=68; maxdepth=29
## [Tune-y] 13: mmce.test.mean=0.588; time: 0.0 min
```

```
## [Tune-x] 14: minsplit=39; maxdepth=19
## [Tune-y] 14: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 15: minsplit=98; maxdepth=24
## [Tune-y] 15: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 16: minsplit=26; maxdepth=13
## [Tune-y] 16: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 17: minsplit=65; maxdepth=5
## [Tune-y] 17: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 18: minsplit=31; maxdepth=13
## [Tune-y] 18: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 19: minsplit=93; maxdepth=12
## [Tune-y] 19: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 20: minsplit=69; maxdepth=9
## [Tune-y] 20: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 21: minsplit=69; maxdepth=25
## [Tune-y] 21: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 22: minsplit=2; maxdepth=19
## [Tune-y] 22: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 23: minsplit=94; maxdepth=18
## [Tune-y] 23: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 24: minsplit=62; maxdepth=5
## [Tune-y] 24: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 25: minsplit=80; maxdepth=15
## [Tune-y] 25: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 26: minsplit=66; maxdepth=30
## [Tune-y] 26: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 27: minsplit=70; maxdepth=22
## [Tune-y] 27: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 28: minsplit=36; maxdepth=4
## [Tune-y] 28: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 29: minsplit=65; maxdepth=11
## [Tune-y] 29: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 30: minsplit=99; maxdepth=16
## [Tune-y] 30: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 31: minsplit=29; maxdepth=3
## [Tune-y] 31: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 32: minsplit=58; maxdepth=9
## [Tune-y] 32: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 33: minsplit=87; maxdepth=13
## [Tune-y] 33: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 34: minsplit=14; maxdepth=4
## [Tune-y] 34: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 35: minsplit=41; maxdepth=15
## [Tune-y] 35: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 36: minsplit=2; maxdepth=3
## [Tune-y] 36: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 37: minsplit=16; maxdepth=12
## [Tune-y] 37: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 38: minsplit=76; maxdepth=21
## [Tune-y] 38: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 39: minsplit=63; maxdepth=14
## [Tune-y] 39: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 40: minsplit=75; maxdepth=13
## [Tune-y] 40: mmce.test.mean=0.588; time: 0.0 min
```

```
## [Tune-x] 41: minsplit=4; maxdepth=21
## [Tune-y] 41: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 42: minsplit=48; maxdepth=4
## [Tune-y] 42: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 43: minsplit=62; maxdepth=16
## [Tune-y] 43: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 44: minsplit=51; maxdepth=2
## [Tune-y] 44: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 45: minsplit=65; maxdepth=27
## [Tune-y] 45: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 46: minsplit=39; maxdepth=25
## [Tune-y] 46: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 47: minsplit=29; maxdepth=10
## [Tune-y] 47: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 48: minsplit=74; maxdepth=13
## [Tune-y] 48: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 49: minsplit=55; maxdepth=5
## [Tune-y] 49: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 50: minsplit=81; maxdepth=12
## [Tune-y] 50: mmce.test.mean=0.588; time: 0.0 min
## [Tune] Result: minsplit=29; maxdepth=10 : mmce.test.mean=0.0147
## mmce.test.mean=0.06
## [Resample] cross-validation iter 2: [Tune] Started tuning learner classif.rpart for parameter set:
##             Type len Def   Constr Req Tunable Trafo
## minsplit integer   -   - 1 to 100   -    TRUE     -
## maxdepth integer   -   -  2 to 30   -    TRUE     -
## With control class: TuneControlRandom
## Imputation value: 1
## [Tune-x] 1: minsplit=46; maxdepth=9
## [Tune-y] 1: mmce.test.mean=0.309; time: 0.0 min
## [Tune-x] 2: minsplit=57; maxdepth=4
## [Tune-y] 2: mmce.test.mean=0.309; time: 0.0 min
## [Tune-x] 3: minsplit=38; maxdepth=15
## [Tune-y] 3: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 4: minsplit=58; maxdepth=7
## [Tune-y] 4: mmce.test.mean=0.309; time: 0.0 min
## [Tune-x] 5: minsplit=61; maxdepth=5
## [Tune-y] 5: mmce.test.mean=0.309; time: 0.0 min
## [Tune-x] 6: minsplit=38; maxdepth=8
## [Tune-y] 6: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 7: minsplit=10; maxdepth=24
## [Tune-y] 7: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 8: minsplit=29; maxdepth=7
## [Tune-y] 8: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 9: minsplit=74; maxdepth=26
## [Tune-y] 9: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 10: minsplit=67; maxdepth=6
## [Tune-y] 10: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 11: minsplit=89; maxdepth=6
## [Tune-y] 11: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 12: minsplit=35; maxdepth=19
## [Tune-y] 12: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 13: minsplit=22; maxdepth=14
## [Tune-y] 13: mmce.test.mean=0.0441; time: 0.0 min
```

```
## [Tune-x] 14: minsplit=75; maxdepth=3
## [Tune-y] 14: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 15: minsplit=5; maxdepth=9
## [Tune-y] 15: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 16: minsplit=30; maxdepth=25
## [Tune-y] 16: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 17: minsplit=17; maxdepth=29
## [Tune-y] 17: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 18: minsplit=11; maxdepth=6
## [Tune-y] 18: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 19: minsplit=90; maxdepth=17
## [Tune-y] 19: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 20: minsplit=2; maxdepth=4
## [Tune-y] 20: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 21: minsplit=71; maxdepth=5
## [Tune-y] 21: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 22: minsplit=80; maxdepth=23
## [Tune-y] 22: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 23: minsplit=70; maxdepth=13
## [Tune-y] 23: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 24: minsplit=33; maxdepth=10
## [Tune-y] 24: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 25: minsplit=26; maxdepth=12
## [Tune-y] 25: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 26: minsplit=49; maxdepth=30
## [Tune-y] 26: mmce.test.mean=0.309; time: 0.0 min
## [Tune-x] 27: minsplit=78; maxdepth=3
## [Tune-y] 27: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 28: minsplit=67; maxdepth=16
## [Tune-y] 28: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 29: minsplit=66; maxdepth=4
## [Tune-y] 29: mmce.test.mean=0.309; time: 0.0 min
## [Tune-x] 30: minsplit=4; maxdepth=13
## [Tune-y] 30: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 31: minsplit=77; maxdepth=12
## [Tune-y] 31: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 32: minsplit=49; maxdepth=29
## [Tune-y] 32: mmce.test.mean=0.309; time: 0.0 min
## [Tune-x] 33: minsplit=68; maxdepth=26
## [Tune-y] 33: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 34: minsplit=9; maxdepth=21
## [Tune-y] 34: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 35: minsplit=21; maxdepth=20
## [Tune-y] 35: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 36: minsplit=45; maxdepth=20
## [Tune-y] 36: mmce.test.mean=0.176; time: 0.0 min
## [Tune-x] 37: minsplit=33; maxdepth=23
## [Tune-y] 37: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 38: minsplit=63; maxdepth=3
## [Tune-y] 38: mmce.test.mean=0.309; time: 0.0 min
## [Tune-x] 39: minsplit=80; maxdepth=30
## [Tune-y] 39: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 40: minsplit=15; maxdepth=23
## [Tune-y] 40: mmce.test.mean=0.0441; time: 0.0 min
```

```
## [Tune-x] 41: minsplit=3; maxdepth=21
## [Tune-y] 41: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 42: minsplit=5; maxdepth=9
## [Tune-y] 42: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 43: minsplit=33; maxdepth=29
## [Tune-y] 43: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 44: minsplit=95; maxdepth=18
## [Tune-y] 44: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 45: minsplit=10; maxdepth=17
## [Tune-y] 45: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 46: minsplit=29; maxdepth=12
## [Tune-y] 46: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 47: minsplit=21; maxdepth=17
## [Tune-y] 47: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 48: minsplit=33; maxdepth=13
## [Tune-y] 48: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 49: minsplit=92; maxdepth=19
## [Tune-y] 49: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 50: minsplit=13; maxdepth=9
## [Tune-y] 50: mmce.test.mean=0.0441; time: 0.0 min
## [Tune] Result: minsplit=2; maxdepth=4 : mmce.test.mean=0.0147
## mmce.test.mean=0.06
## [Resample] cross-validation iter 3: [Tune] Started tuning learner classif.rpart for parameter set:
##             Type len Def   Constr Req Tunable Trafo
## minsplit integer   -   - 1 to 100   -    TRUE     -
## maxdepth integer   -   -  2 to 30   -    TRUE     -
## With control class: TuneControlRandom
## Imputation value: 1
## [Tune-x] 1: minsplit=42; maxdepth=4
## [Tune-y] 1: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 2: minsplit=20; maxdepth=23
## [Tune-y] 2: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 3: minsplit=3; maxdepth=23
## [Tune-y] 3: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 4: minsplit=52; maxdepth=15
## [Tune-y] 4: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 5: minsplit=98; maxdepth=5
## [Tune-y] 5: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 6: minsplit=61; maxdepth=27
## [Tune-y] 6: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 7: minsplit=6; maxdepth=14
## [Tune-y] 7: mmce.test.mean=0.0294; time: 0.0 min
## [Tune-x] 8: minsplit=78; maxdepth=8
## [Tune-y] 8: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 9: minsplit=8; maxdepth=13
## [Tune-y] 9: mmce.test.mean=0.0294; time: 0.0 min
## [Tune-x] 10: minsplit=12; maxdepth=8
## [Tune-y] 10: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 11: minsplit=28; maxdepth=4
## [Tune-y] 11: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 12: minsplit=50; maxdepth=20
## [Tune-y] 12: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 13: minsplit=65; maxdepth=30
## [Tune-y] 13: mmce.test.mean=0.368; time: 0.0 min
```

```
## [Tune-x] 14: minsplit=92; maxdepth=27
## [Tune-y] 14: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 15: minsplit=88; maxdepth=14
## [Tune-y] 15: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 16: minsplit=78; maxdepth=4
## [Tune-y] 16: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 17: minsplit=32; maxdepth=19
## [Tune-y] 17: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 18: minsplit=69; maxdepth=27
## [Tune-y] 18: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 19: minsplit=3; maxdepth=16
## [Tune-y] 19: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 20: minsplit=69; maxdepth=23
## [Tune-y] 20: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 21: minsplit=15; maxdepth=3
## [Tune-y] 21: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 22: minsplit=84; maxdepth=6
## [Tune-y] 22: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 23: minsplit=63; maxdepth=18
## [Tune-y] 23: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 24: minsplit=61; maxdepth=17
## [Tune-y] 24: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 25: minsplit=2; maxdepth=29
## [Tune-y] 25: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 26: minsplit=56; maxdepth=19
## [Tune-y] 26: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 27: minsplit=29; maxdepth=2
## [Tune-y] 27: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 28: minsplit=82; maxdepth=8
## [Tune-y] 28: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 29: minsplit=36; maxdepth=13
## [Tune-y] 29: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 30: minsplit=59; maxdepth=5
## [Tune-y] 30: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 31: minsplit=2; maxdepth=26
## [Tune-y] 31: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 32: minsplit=59; maxdepth=30
## [Tune-y] 32: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 33: minsplit=28; maxdepth=30
## [Tune-y] 33: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 34: minsplit=99; maxdepth=25
## [Tune-y] 34: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 35: minsplit=81; maxdepth=9
## [Tune-y] 35: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 36: minsplit=38; maxdepth=26
## [Tune-y] 36: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 37: minsplit=4; maxdepth=3
## [Tune-y] 37: mmce.test.mean=0.0294; time: 0.0 min
## [Tune-x] 38: minsplit=2; maxdepth=7
## [Tune-y] 38: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 39: minsplit=34; maxdepth=2
## [Tune-y] 39: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 40: minsplit=85; maxdepth=17
## [Tune-y] 40: mmce.test.mean=0.721; time: 0.0 min
```

```
## [Tune-x] 41: minsplit=59; maxdepth=30
## [Tune-y] 41: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 42: minsplit=35; maxdepth=30
## [Tune-y] 42: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 43: minsplit=93; maxdepth=10
## [Tune-y] 43: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 44: minsplit=78; maxdepth=13
## [Tune-y] 44: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 45: minsplit=67; maxdepth=18
## [Tune-y] 45: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 46: minsplit=100; maxdepth=21
## [Tune-y] 46: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 47: minsplit=95; maxdepth=20
## [Tune-y] 47: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 48: minsplit=42; maxdepth=24
## [Tune-y] 48: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 49: minsplit=1; maxdepth=2
## [Tune-y] 49: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 50: minsplit=72; maxdepth=19
## [Tune-y] 50: mmce.test.mean=0.721; time: 0.0 min
## [Tune] Result: minsplit=8; maxdepth=13 : mmce.test.mean=0.0294
## mmce.test.mean=0.02
## [Resample] Aggr. Result: mmce.test.mean=0.0467
```

```
res
```

```
## Resample Result
## Task: iris-example
## Learner: classif.rpart.tuned
## Aggr perf: mmce.test.mean=0.0467
## Runtime: 3.86018
```

Results

```
opt.paths = getNestedTuneResultsOptPathDf(res)
opt.paths
```

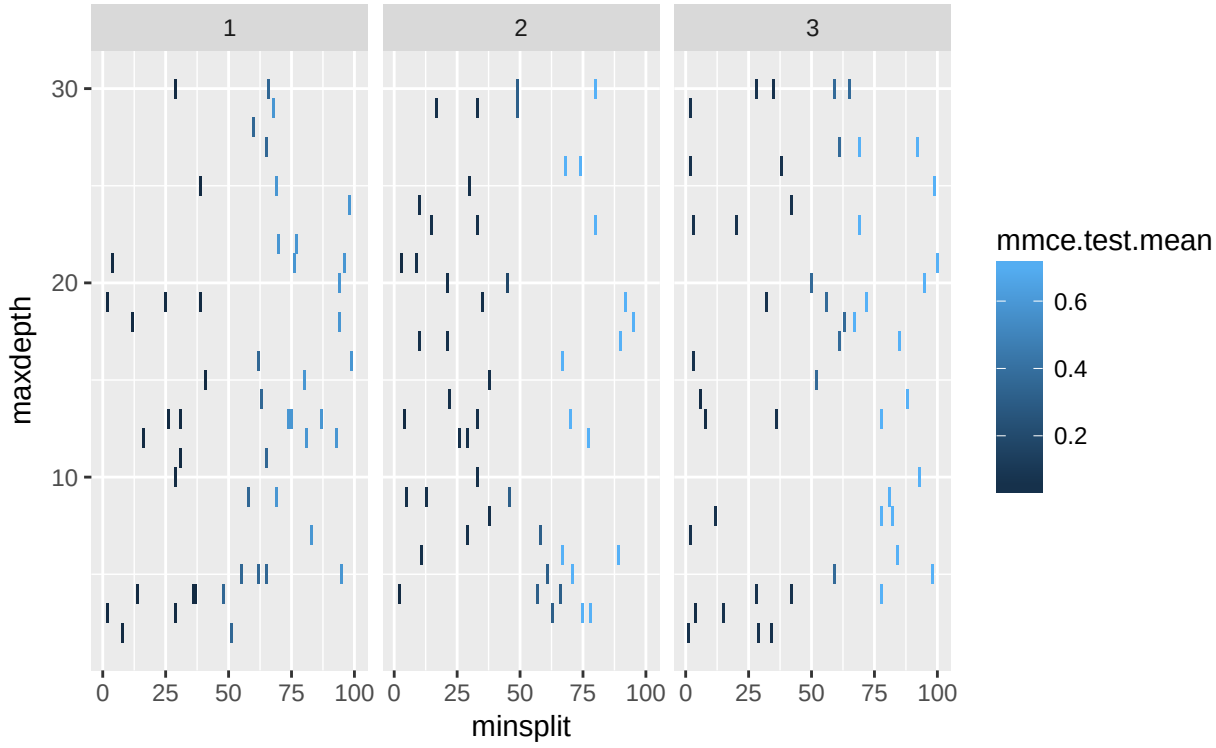
```
##     minsplit maxdepth mmce.test.mean dob eol error.message exec.time iter
## 1          8        2     0.01470588   1  NA          <NA>     0.024    1
## 2         29       30     0.01470588   2  NA          <NA>     0.023    1
## 3         77       22     0.58823529   3  NA          <NA>     0.022    1
## 4         96       21     0.58823529   4  NA          <NA>     0.022    1
## 5         94       20     0.58823529   5  NA          <NA>     0.020    1
## 6         37        4     0.01470588   6  NA          <NA>     0.021    1
## 7         83        7     0.58823529   7  NA          <NA>     0.019    1
## 8         25       19     0.01470588   8  NA          <NA>     0.021    1
## 9         31       11     0.01470588   9  NA          <NA>     0.024    1
## 10        95        5     0.58823529  10  NA          <NA>     0.020    1
## 11        12       18     0.01470588  11  NA          <NA>     0.021    1
## 12        60       28     0.35294118  12  NA          <NA>     0.021    1
## 13        68       29     0.58823529  13  NA          <NA>     0.019    1
## 14        39       19     0.01470588  14  NA          <NA>     0.021    1
## 15        98       24     0.58823529  15  NA          <NA>     0.024    1
## 16        26       13     0.01470588  16  NA          <NA>     0.020    1
```

```
## 17        65        5     0.35294118  17  NA          <NA>     0.020    1
## 18        31       13     0.01470588  18  NA          <NA>     0.020    1
## 19        93       12     0.58823529  19  NA          <NA>     0.019    1
## 20        69        9     0.58823529  20  NA          <NA>     0.023    1
## 21        69       25     0.58823529  21  NA          <NA>     0.020    1
## 22         2       19     0.01470588  22  NA          <NA>     0.020    1
## 23        94       18     0.58823529  23  NA          <NA>     0.019    1
## 24        62        5     0.35294118  24  NA          <NA>     0.021    1
## 25        80       15     0.58823529  25  NA          <NA>     0.019    1
## 26        66       30     0.35294118  26  NA          <NA>     0.024    1
## 27        70       22     0.58823529  27  NA          <NA>     0.019    1
## 28        36        4     0.01470588  28  NA          <NA>     0.020    1
## 29        65       11     0.35294118  29  NA          <NA>     0.020    1
## 30        99       16     0.58823529  30  NA          <NA>     0.019    1
## 31        29        3     0.01470588  31  NA          <NA>     0.024    1
## 32        58        9     0.35294118  32  NA          <NA>     0.021    1
## 33        87       13     0.58823529  33  NA          <NA>     0.019    1
## 34        14        4     0.01470588  34  NA          <NA>     0.020    1
## 35        41       15     0.01470588  35  NA          <NA>     0.020    1
## 36         2        3     0.01470588  36  NA          <NA>     0.021    1
## 37        16       12     0.01470588  37  NA          <NA>     0.026    1
## 38        76       21     0.58823529  38  NA          <NA>     0.033    1
## 39        63       14     0.35294118  39  NA          <NA>     0.025    1
## 40        75       13     0.58823529  40  NA          <NA>     0.020    1
## 41         4       21     0.01470588  41  NA          <NA>     0.021    1
## 42        48        4     0.35294118  42  NA          <NA>     0.025    1
## 43        62       16     0.35294118  43  NA          <NA>     0.021    1
## 44        51        2     0.35294118  44  NA          <NA>     0.021    1
## 45        65       27     0.35294118  45  NA          <NA>     0.021    1
## 46        39       25     0.01470588  46  NA          <NA>     0.021    1
## 47        29       10     0.01470588  47  NA          <NA>     0.024    1
## 48        74       13     0.58823529  48  NA          <NA>     0.020    1
## 49        55        5     0.35294118  49  NA          <NA>     0.020    1
## 50        81       12     0.58823529  50  NA          <NA>     0.018    1
## 51        46        9     0.30882353   1  NA          <NA>     0.020    2
## 52        57        4     0.30882353   2  NA          <NA>     0.020    2
## 53        38       15     0.04411765   3  NA          <NA>     0.021    2
## 54        58        7     0.30882353   4  NA          <NA>     0.025    2
## 55        61        5     0.30882353   5  NA          <NA>     0.022    2
## 56        38        8     0.04411765   6  NA          <NA>     0.021    2
## 57        10       24     0.04411765   7  NA          <NA>     0.021    2
## 58        29        7     0.04411765   8  NA          <NA>     0.021    2
## 59        74       26     0.72058824   9  NA          <NA>     0.019    2
## 60        67        6     0.72058824  10  NA          <NA>     0.020    2
## 61        89        6     0.72058824  11  NA          <NA>     0.019    2
## 62        35       19     0.04411765  12  NA          <NA>     0.021    2
## 63        22       14     0.04411765  13  NA          <NA>     0.022    2
## 64        75        3     0.72058824  14  NA          <NA>     0.019    2
## 65         5        9     0.04411765  15  NA          <NA>     0.024    2
## 66        30       25     0.04411765  16  NA          <NA>     0.022    2
## 67        17       29     0.04411765  17  NA          <NA>     0.021    2
## 68        11        6     0.04411765  18  NA          <NA>     0.020    2
## 69        90       17     0.72058824  19  NA          <NA>     0.019    2
## 70         2        4     0.01470588  20  NA          <NA>     0.021    2
```

```
## 71        71        5     0.72058824  21  NA          <NA>     0.024    2
## 72        80       23     0.72058824  22  NA          <NA>     0.020    2
## 73        70       13     0.72058824  23  NA          <NA>     0.020    2
## 74        33       10     0.04411765  24  NA          <NA>     0.021    2
## 75        26       12     0.04411765  25  NA          <NA>     0.022    2
## 76        49       30     0.30882353  26  NA          <NA>     0.023    2
## 77        78        3     0.72058824  27  NA          <NA>     0.027    2
## 78        67       16     0.72058824  28  NA          <NA>     0.021    2
## 79        66        4     0.30882353  29  NA          <NA>     0.021    2
## 80         4       13     0.01470588  30  NA          <NA>     0.021    2
## 81        77       12     0.72058824  31  NA          <NA>     0.020    2
## 82        49       29     0.30882353  32  NA          <NA>     0.021    2
## 83        68       26     0.72058824  33  NA          <NA>     0.024    2
## 84         9       21     0.04411765  34  NA          <NA>     0.021    2
## 85        21       20     0.04411765  35  NA          <NA>     0.021    2
## 86        45       20     0.17647059  36  NA          <NA>     0.020    2
## 87        33       23     0.04411765  37  NA          <NA>     0.020    2
## 88        63        3     0.30882353  38  NA          <NA>     0.021    2
## 89        80       30     0.72058824  39  NA          <NA>     0.024    2
## 90        15       23     0.04411765  40  NA          <NA>     0.021    2
## 91         3       21     0.01470588  41  NA          <NA>     0.021    2
## 92         5        9     0.04411765  42  NA          <NA>     0.020    2
## 93        33       29     0.04411765  43  NA          <NA>     0.021    2
## 94        95       18     0.72058824  44  NA          <NA>     0.022    2
## 95        10       17     0.04411765  45  NA          <NA>     0.023    2
## 96        29       12     0.04411765  46  NA          <NA>     0.021    2
## 97        21       17     0.04411765  47  NA          <NA>     0.021    2
## 98        33       13     0.04411765  48  NA          <NA>     0.021    2
## 99        92       19     0.72058824  49  NA          <NA>     0.020    2
## 100       13        9     0.04411765  50  NA          <NA>     0.025    2
## 101       42        4     0.05882353   1  NA          <NA>     0.022    3
## 102       20       23     0.05882353   2  NA          <NA>     0.026    3
## 103        3       23     0.05882353   3  NA          <NA>     0.021    3
## 104       52       15     0.36764706   4  NA          <NA>     0.021    3
## 105       98        5     0.72058824   5  NA          <NA>     0.019    3
## 106       61       27     0.36764706   6  NA          <NA>     0.020    3
## 107        6       14     0.02941176   7  NA          <NA>     0.024    3
## 108       78        8     0.72058824   8  NA          <NA>     0.021    3
## 109        8       13     0.02941176   9  NA          <NA>     0.020    3
## 110       12        8     0.05882353  10  NA          <NA>     0.021    3
## 111       28        4     0.05882353  11  NA          <NA>     0.023    3
## 112       50       20     0.36764706  12  NA          <NA>     0.022    3
## 113       65       30     0.36764706  13  NA          <NA>     0.026    3
## 114       92       27     0.72058824  14  NA          <NA>     0.021    3
## 115       88       14     0.72058824  15  NA          <NA>     0.020    3
## 116       78        4     0.72058824  16  NA          <NA>     0.019    3
## 117       32       19     0.05882353  17  NA          <NA>     0.021    3
## 118       69       27     0.72058824  18  NA          <NA>     0.020    3
## 119        3       16     0.05882353  19  NA          <NA>     0.026    3
## 120       69       23     0.72058824  20  NA          <NA>     0.020    3
## 121       15        3     0.05882353  21  NA          <NA>     0.021    3
## 122       84        6     0.72058824  22  NA          <NA>     0.019    3
## 123       63       18     0.36764706  23  NA          <NA>     0.022    3
## 124       61       17     0.36764706  24  NA          <NA>     0.021    3
```

```
## 125        2        29     0.05882353  25  NA          <NA>     0.025     3
## 126       56        19     0.36764706  26  NA          <NA>     0.020     3
## 127       29         2     0.05882353  27  NA          <NA>     0.021     3
## 128       82         8     0.72058824  28  NA          <NA>     0.020     3
## 129       36        13     0.05882353  29  NA          <NA>     0.021     3
## 130       59         5     0.36764706  30  NA          <NA>     0.024     3
## 131        2        26     0.05882353  31  NA          <NA>     0.022     3
## 132       59        30     0.36764706  32  NA          <NA>     0.020     3
## 133       28        30     0.05882353  33  NA          <NA>     0.022     3
## 134       99        25     0.72058824  34  NA          <NA>     0.020     3
## 135       81         9     0.72058824  35  NA          <NA>     0.020     3
## 136       38        26     0.05882353  36  NA          <NA>     0.026     3
## 137        4         3     0.02941176  37  NA          <NA>     0.022     3
## 138        2         7     0.05882353  38  NA          <NA>     0.021     3
## 139       34         2     0.05882353  39  NA          <NA>     0.020     3
## 140       85        17     0.72058824  40  NA          <NA>     0.019     3
## 141       59        30     0.36764706  41  NA          <NA>     0.021     3
## 142       35        30     0.05882353  42  NA          <NA>     0.023     3
## 143       93        10     0.72058824  43  NA          <NA>     0.020     3
## 144       78        13     0.72058824  44  NA          <NA>     0.020     3
## 145       67        18     0.72058824  45  NA          <NA>     0.019     3
## 146      100        21     0.72058824  46  NA          <NA>     0.019     3
## 147       95        20     0.72058824  47  NA          <NA>     0.023     3
## 148       42        24     0.05882353  48  NA          <NA>     0.022     3
## 149        1         2     0.05882353  49  NA          <NA>     0.021     3
## 150       72        19     0.72058824  50  NA          <NA>     0.020     3
```

```
library(ggplot2)
ggplot(opt.paths, aes(x = minsplit, y = maxdepth, fill = mmce.test.mean)) + geom_tile() +
    facet_wrap(~ iter)
```



Model-Based Tuning

Numeric Parameters

```
library(mlrMBO)
```

```
## Loading required package: smoof
```

```
## Loading required package: BBmisc
```

```
##
## Attaching package: 'BBmisc'
```

```
## The following object is masked from 'package:grid':
##
##     explode
```

```
## Loading required package: checkmate
```

```
control = makeMBOControl()
control = setMBOControlTermination(control, iters = 10)
control = setMBOControlInfill(control, crit = makeMBOInfillCritEI())

ctrl = makeTuneControlMBO(mbo.control = control)

lrn = makeTuneWrapper("classif.rpart", resampling = inner, par.set = ps, control = ctrl)
res = resample(lrn, iris.task, resampling = outer, extract = getTuneResult)
```

```
## [Resample] cross-validation iter 1:
```

```
## [Tune] Started tuning learner classif.rpart for parameter set:
```

```
##             Type len Def   Constr Req Tunable Trafo
## minsplit integer   -   - 1 to 100   -    TRUE     -
## maxdepth integer   -   -  2 to 30   -    TRUE     -
```

```
## With control class: TuneControlMBO
```

```
## Imputation value: 1
```

```
## [Tune-x] 1: minsplit=95; maxdepth=20
```

```
## [Tune-y] 1: mmce.test.mean=0.75; time: 0.0 min
```

```
## [Tune-x] 2: minsplit=70; maxdepth=10
```

```
## [Tune-y] 2: mmce.test.mean=0.75; time: 0.0 min
```

```
## [Tune-x] 3: minsplit=35; maxdepth=24
```

```
## [Tune-y] 3: mmce.test.mean=0.0735; time: 0.0 min
```

```
## [Tune-x] 4: minsplit=43; maxdepth=14
```

```
## [Tune-y] 4: mmce.test.mean=0.25; time: 0.0 min
```

```
## [Tune-x] 5: minsplit=23; maxdepth=7
```

```
## [Tune-y] 5: mmce.test.mean=0.0735; time: 0.0 min
```

```
## [Tune-x] 6: minsplit=59; maxdepth=29
```

```
## [Tune-y] 6: mmce.test.mean=0.485; time: 0.0 min
```

```
## [Tune-x] 7: minsplit=82; maxdepth=4

## [Tune-y] 7: mmce.test.mean=0.75; time: 0.0 min

## [Tune-x] 8: minsplit=12; maxdepth=17

## [Tune-y] 8: mmce.test.mean=0.0735; time: 0.0 min

## Loading required package: rgenoud

## ##  rgenoud (Version 5.7-12.4, Build Date: 2015-07-19)
## ##  See http://sekhon.berkeley.edu/rgenoud for additional documentation.
## ##  Please cite software as:
## ##   Walter Mebane, Jr. and Jasjeet S. Sekhon. 2011.
## ##   ``Genetic Optimization Using Derivatives: The rgenoud package for R.''
## ##   Journal of Statistical Software, 42(11): 1-26.
## ##

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 392 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 75 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 26 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 14 points instead of 1000!

## [Tune-x] 9: minsplit=24; maxdepth=30

## [Tune-y] 9: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 764 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 243 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 75 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 27 points instead of 1000!

## [Tune-x] 10: minsplit=27; maxdepth=21

## [Tune-y] 10: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 208 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 24 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 6 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 4 points instead of 1000!

## [Tune-x] 11: minsplit=1; maxdepth=2

## [Tune-y] 11: mmce.test.mean=0.0735; time: 0.0 min
```

```
## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 296 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 57 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 22 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 14 points instead of 1000!

## [Tune-x] 12: minsplit=12; maxdepth=2

## [Tune-y] 12: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 408 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 81 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 30 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 18 points instead of 1000!

## [Tune-x] 13: minsplit=32; maxdepth=30

## [Tune-y] 13: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 312 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 56 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 15 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 6 points instead of 1000!

## [Tune-x] 14: minsplit=1; maxdepth=26

## [Tune-y] 14: mmce.test.mean=0.0735; time: 0.0 min

## Warning in (function (fn, nvars, max = FALSE, pop.size = 1000,
## max.generations = 100, : Stopped because hard maximum generation limit was
## hit.

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 616 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 207 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 65 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 21 points instead of 1000!

## [Tune-x] 15: minsplit=20; maxdepth=24
```

```
## [Tune-y] 15: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 403 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 91 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 35 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 15 points instead of 1000!

## [Tune-x] 16: minsplit=5; maxdepth=9

## [Tune-y] 16: mmce.test.mean=0.0588; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 390 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 72 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 15 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 6 points instead of 1000!

## [Tune-x] 17: minsplit=1; maxdepth=12

## [Tune-y] 17: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 416 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 105 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 45 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 15 points instead of 1000!

## [Tune-x] 18: minsplit=7; maxdepth=24

## [Tune-y] 18: mmce.test.mean=0.0588; time: 0.0 min

## [Tune] Result: minsplit=5; maxdepth=9 : mmce.test.mean=0.0588

## mmce.test.mean=0.08

## [Resample] cross-validation iter 2: [Tune] Started tuning learner classif.rpart for parameter set:
##             Type len Def   Constr Req Tunable Trafo
## minsplit integer   -   - 1 to 100   -    TRUE     -
## maxdepth integer   -   -  2 to 30   -    TRUE     -
## With control class: TuneControlMBO
## Imputation value: 1
## [Tune-x] 1: minsplit=75; maxdepth=6
## [Tune-y] 1: mmce.test.mean=0.676; time: 0.0 min
## [Tune-x] 2: minsplit=56; maxdepth=18
## [Tune-y] 2: mmce.test.mean=0.309; time: 0.0 min
```

```
## [Tune-x] 3: minsplit=33; maxdepth=22
## [Tune-y] 3: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 4: minsplit=83; maxdepth=25
## [Tune-y] 4: mmce.test.mean=0.676; time: 0.0 min
## [Tune-x] 5: minsplit=42; maxdepth=3
## [Tune-y] 5: mmce.test.mean=0.162; time: 0.0 min
## [Tune-x] 6: minsplit=6; maxdepth=13
## [Tune-y] 6: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 7: minsplit=13; maxdepth=28
## [Tune-y] 7: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 8: minsplit=92; maxdepth=11
## [Tune-y] 8: mmce.test.mean=0.676; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 690 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 225 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 65 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 21 points instead of 1000!

## [Tune-x] 9: minsplit=21; maxdepth=16
## [Tune-y] 9: mmce.test.mean=0.0441; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 364 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 72 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 15 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 6 points instead of 1000!

## [Tune-x] 10: minsplit=1; maxdepth=23
## [Tune-y] 10: mmce.test.mean=0.0441; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 459 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 81 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 30 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 18 points instead of 1000!

## [Tune-x] 11: minsplit=27; maxdepth=30
## [Tune-y] 11: mmce.test.mean=0.0441; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 495 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
```

```
## ps.local, : generateDesign could only produce 153 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 45 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 15 points instead of 1000!

## [Tune-x] 12: minsplit=9; maxdepth=21
## [Tune-y] 12: mmce.test.mean=0.0441; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 208 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 24 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 6 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 4 points instead of 1000!

## [Tune-x] 13: minsplit=1; maxdepth=2
## [Tune-y] 13: mmce.test.mean=0.0441; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 765 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 243 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 75 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 27 points instead of 1000!

## [Tune-x] 14: minsplit=26; maxdepth=23
## [Tune-y] 14: mmce.test.mean=0.0441; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 615 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 189 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 55 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 21 points instead of 1000!

## [Tune-x] 15: minsplit=17; maxdepth=21
## [Tune-y] 15: mmce.test.mean=0.0441; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 390 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 72 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 15 points instead of 1000!
```

```
## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 6 points instead of 1000!

## [Tune-x] 16: minsplit=1; maxdepth=15
## [Tune-y] 16: mmce.test.mean=0.0441; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 232 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 33 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 14 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 10 points instead of 1000!

## [Tune-x] 17: minsplit=4; maxdepth=30
## [Tune-y] 17: mmce.test.mean=0.0588; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 518 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 171 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 55 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 21 points instead of 1000!

## [Tune-x] 18: minsplit=13; maxdepth=7
## [Tune-y] 18: mmce.test.mean=0.0441; time: 0.0 min
## [Tune] Result: minsplit=1; maxdepth=15 : mmce.test.mean=0.0441
## mmce.test.mean=0.08
## [Resample] cross-validation iter 3: [Tune] Started tuning learner classif.rpart for parameter set:
##             Type len Def   Constr Req Tunable Trafo
## minsplit integer   -   - 1 to 100   -    TRUE     -
## maxdepth integer   -   -  2 to 30   -    TRUE     -
## With control class: TuneControlMBO
## Imputation value: 1
## [Tune-x] 1: minsplit=2; maxdepth=2
## [Tune-y] 1: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 2: minsplit=46; maxdepth=22
## [Tune-y] 2: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 3: minsplit=76; maxdepth=12
## [Tune-y] 3: mmce.test.mean=0.706; time: 0.0 min
## [Tune-x] 4: minsplit=97; maxdepth=19
## [Tune-y] 4: mmce.test.mean=0.706; time: 0.0 min
## [Tune-x] 5: minsplit=22; maxdepth=26
## [Tune-y] 5: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 6: minsplit=54; maxdepth=15
## [Tune-y] 6: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 7: minsplit=35; maxdepth=8
## [Tune-y] 7: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 8: minsplit=65; maxdepth=29
## [Tune-y] 8: mmce.test.mean=0.368; time: 0.0 min
```

```
## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 336 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 69 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 26 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 14 points instead of 1000!

## [Tune-x] 9: minsplit=17; maxdepth=2
## [Tune-y] 9: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 570 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 189 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 55 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 21 points instead of 1000!

## [Tune-x] 10: minsplit=12; maxdepth=10
## [Tune-y] 10: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 360 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 69 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 26 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 14 points instead of 1000!

## [Tune-x] 11: minsplit=20; maxdepth=2
## [Tune-y] 11: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 216 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 24 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 6 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 4 points instead of 1000!

## [Tune-x] 12: minsplit=1; maxdepth=30
## [Tune-y] 12: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 328 points instead of 1000!
```

```
## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 63 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 22 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 14 points instead of 1000!

## [Tune-x] 13: minsplit=17; maxdepth=30
## [Tune-y] 13: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 459 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 135 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 45 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 27 points instead of 1000!

## [Tune-x] 14: minsplit=30; maxdepth=4
## [Tune-y] 14: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 686 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 225 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 65 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 21 points instead of 1000!

## [Tune-x] 15: minsplit=24; maxdepth=8
## [Tune-y] 15: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 403 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 98 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 45 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 15 points instead of 1000!

## [Tune-x] 16: minsplit=6; maxdepth=25
## [Tune-y] 16: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 390 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 72 points instead of 1000!
```

```
## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 15 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 6 points instead of 1000!

## [Tune-x] 17: minsplit=1; maxdepth=16
## [Tune-y] 17: mmce.test.mean=0.0735; time: 0.0 min

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 660 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 207 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 65 points instead of 1000!

## Warning in generateDesign(control$infill.opt.focussearch.points,
## ps.local, : generateDesign could only produce 21 points instead of 1000!

## [Tune-x] 18: minsplit=19; maxdepth=15
## [Tune-y] 18: mmce.test.mean=0.0735; time: 0.0 min
## [Tune] Result: minsplit=1; maxdepth=16 : mmce.test.mean=0.0735
## mmce.test.mean=0.04
## [Resample] Aggr. Result: mmce.test.mean=0.0667
res

## Resample Result
## Task: iris-example
## Learner: classif.rpart.tuned
## Aggr perf: mmce.test.mean=0.0667
## Runtime: 14.0852
```

Combining Feature and Model Selection

```
ps = makeParamSet(
    makeDiscreteParam("fw.method", values = c("anova.test", "variance")),
    makeNumericParam("fw.perc", lower = 0.1, upper = 1),
    makeDiscreteParam("selected.learner", values = c("classif.svm", "classif.naiveBayes")),
    makeNumericParam("classif.svm.cost", -15, 15, trafo = function(x) 2^x,
      require = quote(selected.learner == "classif.svm")),
    makeNumericParam("classif.svm.gamma", -15, 15, trafo = function(x) 2^x,
      requires = quote(classif.svm.kernel == "radial" & selected.learner == "classif.svm")),
    makeIntegerParam("classif.svm.degree", lower = 1, upper = 4,
      requires = quote(classif.svm.kernel == "polynomial" & selected.learner == "classif.svm")),
    makeDiscreteParam("classif.svm.kernel", values = c("radial", "polynomial", "linear"),
      require = quote(selected.learner == "classif.svm"))
)

ctrl = makeMBOControl()
ctrl = setMBOControlTermination(ctrl, iters = 10)
lrn = makeFilterWrapper(makeModelMultiplexer(list("classif.svm", "classif.naiveBayes")))
tune.ctrl = makeTuneControlMBO(mbo.control = ctrl)
```

```
lrn = makeTuneWrapper(lrn, resampling = inner, par.set = ps, control = tune.ctrl)
res = resample(lrn, iris.task, resampling = outer, extract = getTuneResult)
```

```
## [Resample] cross-validation iter 1: [Tune] Started tuning learner ModelMultiplexer.filtered for paran
##                        Type len Def                         Constr Req
## fw.method          discrete   -   -            anova.test,variance   -
## fw.perc             numeric   -   -                        0.1 to 1   -
## selected.learner   discrete   -   - classif.svm,classif.naiveBayes   -
## classif.svm.cost    numeric   -   -                      -15 to 15   Y
## classif.svm.gamma   numeric   -   -                      -15 to 15   Y
## classif.svm.degree  integer   -   -                         1 to 4   Y
## classif.svm.kernel discrete   -   -       radial,polynomial,linear   Y
##                    Tunable Trafo
## fw.method             TRUE     -
## fw.perc               TRUE     -
## selected.learner      TRUE     -
## classif.svm.cost      TRUE     Y
## classif.svm.gamma     TRUE     Y
## classif.svm.degree    TRUE     -
## classif.svm.kernel    TRUE     -
## With control class: TuneControlMBO
## Imputation value: 1
## [Tune-x] 1: fw.method=variance; fw.perc=0.677; selected.learner=classif.naiveBayes
## [Tune-y] 1: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 2: fw.method=variance; fw.perc=0.694; selected.learner=classif.svm; classif.svm.cost=0.0013
## [Tune-y] 2: mmce.test.mean=0.735; time: 0.0 min
## [Tune-x] 3: fw.method=anova.test; fw.perc=0.442; selected.learner=classif.naiveBayes
## [Tune-y] 3: mmce.test.mean=0.0294; time: 0.0 min
## [Tune-x] 4: fw.method=anova.test; fw.perc=0.547; selected.learner=classif.svm; classif.svm.cost=0.083
## [Tune-y] 4: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 5: fw.method=anova.test; fw.perc=0.398; selected.learner=classif.naiveBayes
## [Tune-y] 5: mmce.test.mean=0.0294; time: 0.0 min
## [Tune-x] 6: fw.method=variance; fw.perc=0.636; selected.learner=classif.naiveBayes
## [Tune-y] 6: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 7: fw.method=variance; fw.perc=0.31; selected.learner=classif.svm; classif.svm.cost=0.613; c
## [Tune-y] 7: mmce.test.mean=0.294; time: 0.0 min
## [Tune-x] 8: fw.method=anova.test; fw.perc=0.818; selected.learner=classif.naiveBayes
## [Tune-y] 8: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 9: fw.method=anova.test; fw.perc=0.179; selected.learner=classif.naiveBayes
## [Tune-y] 9: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 10: fw.method=anova.test; fw.perc=0.801; selected.learner=classif.svm; classif.svm.cost=0.18
## [Tune-y] 10: mmce.test.mean=0.324; time: 0.0 min
## [Tune-x] 11: fw.method=variance; fw.perc=0.909; selected.learner=classif.svm; classif.svm.cost=969; c
## [Tune-y] 11: mmce.test.mean=0.103; time: 0.0 min
## [Tune-x] 12: fw.method=variance; fw.perc=0.871; selected.learner=classif.naiveBayes
## [Tune-y] 12: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 13: fw.method=anova.test; fw.perc=0.287; selected.learner=classif.naiveBayes
## [Tune-y] 13: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 14: fw.method=variance; fw.perc=0.555; selected.learner=classif.naiveBayes
## [Tune-y] 14: mmce.test.mean=0.0882; time: 0.0 min
## [Tune-x] 15: fw.method=variance; fw.perc=0.152; selected.learner=classif.naiveBayes
## [Tune-y] 15: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 16: fw.method=anova.test; fw.perc=0.995; selected.learner=classif.naiveBayes
## [Tune-y] 16: mmce.test.mean=0.0147; time: 0.0 min
```

```
## [Tune-x] 17: fw.method=variance; fw.perc=0.208; selected.learner=classif.svm; classif.svm.cost=7.28;
## [Tune-y] 17: mmce.test.mean=0.574; time: 0.0 min
## [Tune-x] 18: fw.method=anova.test; fw.perc=0.603; selected.learner=classif.svm; classif.svm.cost=8.18
## [Tune-y] 18: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 19: fw.method=variance; fw.perc=0.772; selected.learner=classif.svm; classif.svm.cost=4.07e-
## [Tune-y] 19: mmce.test.mean=0.735; time: 0.0 min
## [Tune-x] 20: fw.method=anova.test; fw.perc=0.472; selected.learner=classif.svm; classif.svm.cost=0.0
## [Tune-y] 20: mmce.test.mean=0.735; time: 0.0 min
## [Tune-x] 21: fw.method=anova.test; fw.perc=0.516; selected.learner=classif.naiveBayes
## [Tune-y] 21: mmce.test.mean=0.0294; time: 0.0 min
## [Tune-x] 22: fw.method=anova.test; fw.perc=0.903; selected.learner=classif.svm; classif.svm.cost=0.0
## [Tune-y] 22: mmce.test.mean=0.735; time: 0.0 min
## [Tune-x] 23: fw.method=variance; fw.perc=0.35; selected.learner=classif.svm; classif.svm.cost=2.99; c
## [Tune-y] 23: mmce.test.mean=0.132; time: 0.0 min
## [Tune-x] 24: fw.method=anova.test; fw.perc=0.95; selected.learner=classif.svm; classif.svm.cost=3.29e
## [Tune-y] 24: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 25: fw.method=variance; fw.perc=0.386; selected.learner=classif.svm; classif.svm.cost=9.34;
## [Tune-y] 25: mmce.test.mean=0.559; time: 0.0 min
## [Tune-x] 26: fw.method=anova.test; fw.perc=0.244; selected.learner=classif.naiveBayes
## [Tune-y] 26: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 27: fw.method=variance; fw.perc=0.125; selected.learner=classif.svm; classif.svm.cost=2.46e-
## [Tune-y] 27: mmce.test.mean=0.706; time: 0.0 min
## [Tune-x] 28: fw.method=variance; fw.perc=0.737; selected.learner=classif.naiveBayes
## [Tune-y] 28: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 29: fw.method=anova.test; fw.perc=0.623; selected.learner=classif.svm; classif.svm.cost=1.22
## [Tune-y] 29: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 30: fw.method=variance; fw.perc=0.105; selected.learner=classif.naiveBayes
## [Tune-y] 30: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 31: fw.method=variance; fw.perc=0.141; selected.learner=classif.naiveBayes
## [Tune-y] 31: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 32: fw.method=variance; fw.perc=0.134; selected.learner=classif.naiveBayes
## [Tune-y] 32: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 33: fw.method=variance; fw.perc=0.108; selected.learner=classif.naiveBayes
## [Tune-y] 33: mmce.test.mean=0.721; time: 0.0 min
## [Tune-x] 34: fw.method=variance; fw.perc=0.13; selected.learner=classif.naiveBayes
## [Tune-y] 34: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 35: fw.method=anova.test; fw.perc=0.649; selected.learner=classif.svm; classif.svm.cost=3.8e
## [Tune-y] 35: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 36: fw.method=anova.test; fw.perc=0.647; selected.learner=classif.svm; classif.svm.cost=141
## [Tune-y] 36: mmce.test.mean=0.0294; time: 0.0 min
## [Tune-x] 37: fw.method=anova.test; fw.perc=0.503; selected.learner=classif.svm; classif.svm.cost=37.5
## [Tune-y] 37: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 38: fw.method=variance; fw.perc=0.127; selected.learner=classif.naiveBayes
## [Tune-y] 38: mmce.test.mean=0.0588; time: 0.0 min
## [Tune] Result: fw.method=variance; fw.perc=0.737; selected.learner=classif.naiveBayes : mmce.test.mea
## mmce.test.mean=0.02
## [Resample] cross-validation iter 2: [Tune] Started tuning learner ModelMultiplexer.filtered for paran
##                         Type len Def                          Constr Req
## fw.method           discrete   -   -            anova.test,variance   -
## fw.perc              numeric   -   -                        0.1 to 1   -
## selected.learner    discrete   -   - classif.svm,classif.naiveBayes   -
## classif.svm.cost     numeric   -   -                      -15 to 15   Y
## classif.svm.gamma    numeric   -   -                      -15 to 15   Y
## classif.svm.degree   integer   -   -                         1 to 4   Y
```

```
## classif.svm.kernel discrete   -   -       radial,polynomial,linear   Y
##                     Tunable Trafo
## fw.method              TRUE     -
## fw.perc                TRUE     -
## selected.learner       TRUE     -
## classif.svm.cost       TRUE     Y
## classif.svm.gamma      TRUE     Y
## classif.svm.degree     TRUE     -
## classif.svm.kernel     TRUE     -
## With control class: TuneControlMBO
## Imputation value: 1
## [Tune-x] 1: fw.method=anova.test; fw.perc=0.291; selected.learner=classif.svm; classif.svm.cost=0.00
## [Tune-y] 1: mmce.test.mean=0.647; time: 0.0 min
## [Tune-x] 2: fw.method=variance; fw.perc=0.529; selected.learner=classif.svm; classif.svm.cost=6.23e+
## [Tune-y] 2: mmce.test.mean=0.147; time: 0.0 min
## [Tune-x] 3: fw.method=variance; fw.perc=0.326; selected.learner=classif.naiveBayes
## [Tune-y] 3: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 4: fw.method=anova.test; fw.perc=0.179; selected.learner=classif.naiveBayes
## [Tune-y] 4: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 5: fw.method=variance; fw.perc=0.835; selected.learner=classif.naiveBayes
## [Tune-y] 5: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 6: fw.method=variance; fw.perc=0.305; selected.learner=classif.svm; classif.svm.cost=0.0004
## [Tune-y] 6: mmce.test.mean=0.647; time: 0.0 min
## [Tune-x] 7: fw.method=anova.test; fw.perc=0.557; selected.learner=classif.naiveBayes
## [Tune-y] 7: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 8: fw.method=anova.test; fw.perc=0.866; selected.learner=classif.svm; classif.svm.cost=0.00
## [Tune-y] 8: mmce.test.mean=0.456; time: 0.0 min
## [Tune-x] 9: fw.method=anova.test; fw.perc=0.8; selected.learner=classif.naiveBayes
## [Tune-y] 9: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 10: fw.method=variance; fw.perc=0.607; selected.learner=classif.naiveBayes
## [Tune-y] 10: mmce.test.mean=0.132; time: 0.0 min
## [Tune-x] 11: fw.method=variance; fw.perc=0.133; selected.learner=classif.svm; classif.svm.cost=0.061
## [Tune-y] 11: mmce.test.mean=0.368; time: 0.0 min
## [Tune-x] 12: fw.method=anova.test; fw.perc=0.517; selected.learner=classif.naiveBayes
## [Tune-y] 12: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 13: fw.method=variance; fw.perc=0.373; selected.learner=classif.naiveBayes
## [Tune-y] 13: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 14: fw.method=variance; fw.perc=0.76; selected.learner=classif.svm; classif.svm.cost=0.0032
## [Tune-y] 14: mmce.test.mean=0.647; time: 0.0 min
## [Tune-x] 15: fw.method=anova.test; fw.perc=0.711; selected.learner=classif.naiveBayes
## [Tune-y] 15: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 16: fw.method=variance; fw.perc=0.457; selected.learner=classif.svm; classif.svm.cost=966; c
## [Tune-y] 16: mmce.test.mean=0.103; time: 0.0 min
## [Tune-x] 17: fw.method=anova.test; fw.perc=0.436; selected.learner=classif.naiveBayes
## [Tune-y] 17: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 18: fw.method=anova.test; fw.perc=0.982; selected.learner=classif.svm; classif.svm.cost=32.9
## [Tune-y] 18: mmce.test.mean=0.632; time: 0.0 min
## [Tune-x] 19: fw.method=variance; fw.perc=0.407; selected.learner=classif.naiveBayes
## [Tune-y] 19: mmce.test.mean=0.132; time: 0.0 min
## [Tune-x] 20: fw.method=variance; fw.perc=0.71; selected.learner=classif.naiveBayes
## [Tune-y] 20: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 21: fw.method=anova.test; fw.perc=0.229; selected.learner=classif.svm; classif.svm.cost=3.15
## [Tune-y] 21: mmce.test.mean=0.647; time: 0.0 min
## [Tune-x] 22: fw.method=anova.test; fw.perc=0.207; selected.learner=classif.svm; classif.svm.cost=0.0
```

```
## [Tune-y] 22: mmce.test.mean=0.647; time: 0.0 min
## [Tune-x] 23: fw.method=variance; fw.perc=0.961; selected.learner=classif.naiveBayes
## [Tune-y] 23: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 24: fw.method=variance; fw.perc=0.114; selected.learner=classif.svm; classif.svm.cost=2.25e
## [Tune-y] 24: mmce.test.mean=0.647; time: 0.0 min
## [Tune-x] 25: fw.method=anova.test; fw.perc=0.909; selected.learner=classif.svm; classif.svm.cost=0.9
## [Tune-y] 25: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 26: fw.method=variance; fw.perc=0.624; selected.learner=classif.svm; classif.svm.cost=0.228
## [Tune-y] 26: mmce.test.mean=0.647; time: 0.0 min
## [Tune-x] 27: fw.method=anova.test; fw.perc=0.873; selected.learner=classif.svm; classif.svm.cost=409
## [Tune-y] 27: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 28: fw.method=anova.test; fw.perc=0.67; selected.learner=classif.naiveBayes
## [Tune-y] 28: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 29: fw.method=anova.test; fw.perc=0.87; selected.learner=classif.svm; classif.svm.cost=154;
## [Tune-y] 29: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 30: fw.method=anova.test; fw.perc=0.932; selected.learner=classif.svm; classif.svm.cost=0.6
## [Tune-y] 30: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 31: fw.method=anova.test; fw.perc=0.69; selected.learner=classif.svm; classif.svm.cost=0.95
## [Tune-y] 31: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 32: fw.method=anova.test; fw.perc=0.4; selected.learner=classif.svm; classif.svm.cost=0.396
## [Tune-y] 32: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 33: fw.method=anova.test; fw.perc=0.421; selected.learner=classif.svm; classif.svm.cost=0.3
## [Tune-y] 33: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 34: fw.method=anova.test; fw.perc=0.191; selected.learner=classif.naiveBayes
## [Tune-y] 34: mmce.test.mean=0.0735; time: 0.0 min
## [Tune-x] 35: fw.method=anova.test; fw.perc=0.368; selected.learner=classif.svm; classif.svm.cost=0.2
## [Tune-y] 35: mmce.test.mean=0.0882; time: 0.0 min
## [Tune-x] 36: fw.method=variance; fw.perc=0.133; selected.learner=classif.svm; classif.svm.cost=1.11e
## [Tune-y] 36: mmce.test.mean=0.0882; time: 0.0 min
## [Tune-x] 37: fw.method=variance; fw.perc=0.144; selected.learner=classif.svm; classif.svm.cost=1.48e
## [Tune-y] 37: mmce.test.mean=0.0882; time: 0.0 min
## [Tune-x] 38: fw.method=variance; fw.perc=0.116; selected.learner=classif.svm; classif.svm.cost=2.95e
## [Tune-y] 38: mmce.test.mean=0.765; time: 0.0 min
## [Tune] Result: fw.method=anova.test; fw.perc=0.4; selected.learner=classif.svm; classif.svm.cost=0.3
## mmce.test.mean=0.06
## [Resample] cross-validation iter 3: [Tune] Started tuning learner ModelMultiplexer.filtered for para
##                       Type len Def                          Constr Req
## fw.method          discrete   -   -            anova.test,variance   -
## fw.perc             numeric   -   -                       0.1 to 1   -
## selected.learner   discrete   -   - classif.svm,classif.naiveBayes   -
## classif.svm.cost    numeric   -   -                     -15 to 15   Y
## classif.svm.gamma   numeric   -   -                     -15 to 15   Y
## classif.svm.degree  integer   -   -                        1 to 4   Y
## classif.svm.kernel discrete   -   -       radial,polynomial,linear   Y
##                    Tunable Trafo
## fw.method             TRUE     -
## fw.perc               TRUE     -
## selected.learner      TRUE     -
## classif.svm.cost      TRUE     Y
## classif.svm.gamma     TRUE     Y
## classif.svm.degree    TRUE     -
## classif.svm.kernel    TRUE     -
## With control class: TuneControlMBO
## Imputation value: 1
```

```
## [Tune-x] 1: fw.method=anova.test; fw.perc=0.839; selected.learner=classif.svm; classif.svm.cost=966;
## [Tune-y] 1: mmce.test.mean=0.0294; time: 0.0 min
## [Tune-x] 2: fw.method=anova.test; fw.perc=0.675; selected.learner=classif.naiveBayes
## [Tune-y] 2: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 3: fw.method=anova.test; fw.perc=0.551; selected.learner=classif.svm; classif.svm.cost=0.029
## [Tune-y] 3: mmce.test.mean=0.324; time: 0.0 min
## [Tune-x] 4: fw.method=variance; fw.perc=0.329; selected.learner=classif.naiveBayes
## [Tune-y] 4: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 5: fw.method=anova.test; fw.perc=0.52; selected.learner=classif.naiveBayes
## [Tune-y] 5: mmce.test.mean=   0; time: 0.0 min
## [Tune-x] 6: fw.method=variance; fw.perc=0.172; selected.learner=classif.svm; classif.svm.cost=188; cl
## [Tune-y] 6: mmce.test.mean=0.176; time: 0.0 min
## [Tune-x] 7: fw.method=variance; fw.perc=0.275; selected.learner=classif.naiveBayes
## [Tune-y] 7: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 8: fw.method=variance; fw.perc=0.51; selected.learner=classif.naiveBayes
## [Tune-y] 8: mmce.test.mean=0.0882; time: 0.0 min
## [Tune-x] 9: fw.method=anova.test; fw.perc=0.692; selected.learner=classif.naiveBayes
## [Tune-y] 9: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 10: fw.method=variance; fw.perc=0.61; selected.learner=classif.svm; classif.svm.cost=5.38e-0
## [Tune-y] 10: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 11: fw.method=variance; fw.perc=0.385; selected.learner=classif.naiveBayes
## [Tune-y] 11: mmce.test.mean=0.0882; time: 0.0 min
## [Tune-x] 12: fw.method=anova.test; fw.perc=0.857; selected.learner=classif.svm; classif.svm.cost=0.70
## [Tune-y] 12: mmce.test.mean=0.103; time: 0.0 min
## [Tune-x] 13: fw.method=anova.test; fw.perc=0.994; selected.learner=classif.naiveBayes
## [Tune-y] 13: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 14: fw.method=variance; fw.perc=0.886; selected.learner=classif.svm; classif.svm.cost=0.000
## [Tune-y] 14: mmce.test.mean=0.676; time: 0.0 min
## [Tune-x] 15: fw.method=variance; fw.perc=0.93; selected.learner=classif.svm; classif.svm.cost=0.0005
## [Tune-y] 15: mmce.test.mean=0.397; time: 0.0 min
## [Tune-x] 16: fw.method=anova.test; fw.perc=0.47; selected.learner=classif.svm; classif.svm.cost=7.61
## [Tune-y] 16: mmce.test.mean=0.0147; time: 0.0 min
## [Tune-x] 17: fw.method=variance; fw.perc=0.26; selected.learner=classif.svm; classif.svm.cost=2.4; cl
## [Tune-y] 17: mmce.test.mean=0.0882; time: 0.0 min
## [Tune-x] 18: fw.method=variance; fw.perc=0.768; selected.learner=classif.svm; classif.svm.cost=2.91e-
## [Tune-y] 18: mmce.test.mean=0.0294; time: 0.0 min
## [Tune-x] 19: fw.method=anova.test; fw.perc=0.322; selected.learner=classif.naiveBayes
## [Tune-y] 19: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 20: fw.method=anova.test; fw.perc=0.787; selected.learner=classif.naiveBayes
## [Tune-y] 20: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 21: fw.method=anova.test; fw.perc=0.125; selected.learner=classif.naiveBayes
## [Tune-y] 21: mmce.test.mean=0.662; time: 0.0 min
## [Tune-x] 22: fw.method=variance; fw.perc=0.624; selected.learner=classif.naiveBayes
## [Tune-y] 22: mmce.test.mean=0.0882; time: 0.0 min
## [Tune-x] 23: fw.method=variance; fw.perc=0.16; selected.learner=classif.svm; classif.svm.cost=0.366;
## [Tune-y] 23: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 24: fw.method=variance; fw.perc=0.729; selected.learner=classif.naiveBayes
## [Tune-y] 24: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 25: fw.method=anova.test; fw.perc=0.207; selected.learner=classif.svm; classif.svm.cost=9.71
## [Tune-y] 25: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 26: fw.method=anova.test; fw.perc=0.957; selected.learner=classif.svm; classif.svm.cost=0.00
## [Tune-y] 26: mmce.test.mean=0.353; time: 0.0 min
## [Tune-x] 27: fw.method=variance; fw.perc=0.442; selected.learner=classif.naiveBayes
## [Tune-y] 27: mmce.test.mean=0.0882; time: 0.0 min
```

```
## [Tune-x] 28: fw.method=anova.test; fw.perc=0.421; selected.learner=classif.svm; classif.svm.cost=0.0
## [Tune-y] 28: mmce.test.mean=0.588; time: 0.0 min
## [Tune-x] 29: fw.method=anova.test; fw.perc=0.131; selected.learner=classif.naiveBayes
## [Tune-y] 29: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 30: fw.method=anova.test; fw.perc=0.118; selected.learner=classif.naiveBayes
## [Tune-y] 30: mmce.test.mean=0.662; time: 0.0 min
## [Tune-x] 31: fw.method=anova.test; fw.perc=0.131; selected.learner=classif.naiveBayes
## [Tune-y] 31: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 32: fw.method=anova.test; fw.perc=0.125; selected.learner=classif.naiveBayes
## [Tune-y] 32: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 33: fw.method=anova.test; fw.perc=0.127; selected.learner=classif.naiveBayes
## [Tune-y] 33: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 34: fw.method=anova.test; fw.perc=0.674; selected.learner=classif.svm; classif.svm.cost=0.1
## [Tune-y] 34: mmce.test.mean=0.0441; time: 0.0 min
## [Tune-x] 35: fw.method=anova.test; fw.perc=0.126; selected.learner=classif.naiveBayes
## [Tune-y] 35: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 36: fw.method=variance; fw.perc=0.125; selected.learner=classif.naiveBayes
## [Tune-y] 36: mmce.test.mean=0.0588; time: 0.0 min
## [Tune-x] 37: fw.method=anova.test; fw.perc=0.858; selected.learner=classif.svm; classif.svm.cost=0.0
## [Tune-y] 37: mmce.test.mean=0.0882; time: 0.0 min
## [Tune-x] 38: fw.method=anova.test; fw.perc=0.125; selected.learner=classif.naiveBayes
## [Tune-y] 38: mmce.test.mean=0.618; time: 0.0 min
## [Tune] Result: fw.method=anova.test; fw.perc=0.52; selected.learner=classif.naiveBayes : mmce.test.m
## mmce.test.mean=0.08
## [Resample] Aggr. Result: mmce.test.mean=0.0533
```

```
res
```

```
## Resample Result
## Task: iris-example
## Learner: ModelMultiplexer.filtered.tuned
## Aggr perf: mmce.test.mean=0.0533
## Runtime: 33.886
```

Results

```
opt.paths = getNestedTuneResultsOptPathDf(res)
opt.paths
```

```
##      fw.method   fw.perc   selected.learner classif.svm.cost
## 1     variance 0.6773423 classif.naiveBayes              NA
## 2     variance 0.6944169        classif.svm      -9.54717422
## 3   anova.test 0.4417166 classif.naiveBayes              NA
## 4   anova.test 0.5469462        classif.svm      -3.58550977
## 5   anova.test 0.3979504 classif.naiveBayes              NA
## 6     variance 0.6357023 classif.naiveBayes              NA
## 7     variance 0.3095897        classif.svm      -0.70711450
## 8   anova.test 0.8175126 classif.naiveBayes              NA
## 9   anova.test 0.1788870 classif.naiveBayes              NA
## 10  anova.test 0.8012258        classif.svm      -2.43322045
## 11    variance 0.9090346        classif.svm       9.92087392
## 12    variance 0.8710770 classif.naiveBayes              NA
## 13  anova.test 0.2869447 classif.naiveBayes              NA
## 14    variance 0.5547228 classif.naiveBayes              NA
```

```
## 15    variance 0.1518397 classif.naiveBayes              NA
## 16  anova.test 0.9948260 classif.naiveBayes              NA
## 17    variance 0.2084204        classif.svm      2.86462197
## 18  anova.test 0.6034864        classif.svm     12.99720149
## 19    variance 0.7723474        classif.svm    -14.58329450
## 20  anova.test 0.4722081        classif.svm    -13.26504803
## 21  anova.test 0.5160914 classif.naiveBayes              NA
## 22  anova.test 0.9026370        classif.svm     -6.29760417
## 23    variance 0.3497714        classif.svm      1.58007323
## 24  anova.test 0.9503654        classif.svm     11.68559085
## 25    variance 0.3862975        classif.svm      3.22396756
## 26  anova.test 0.2443219 classif.naiveBayes              NA
## 27    variance 0.1245751        classif.svm     14.58602711
## 28    variance 0.7365471 classif.naiveBayes              NA
## 29  anova.test 0.6229348        classif.svm     13.57780070
## 30    variance 0.1046354 classif.naiveBayes              NA
## 31    variance 0.1412555 classif.naiveBayes              NA
## 32    variance 0.1336961 classif.naiveBayes              NA
## 33    variance 0.1079798 classif.naiveBayes              NA
## 34    variance 0.1296517 classif.naiveBayes              NA
## 35  anova.test 0.6494554        classif.svm     11.89072378
## 36  anova.test 0.6468814        classif.svm      7.14176674
## 37  anova.test 0.5031532        classif.svm      5.23009080
## 38    variance 0.1272567 classif.naiveBayes              NA
## 39  anova.test 0.2912642        classif.svm     -9.24269920
## 40    variance 0.5289484        classif.svm     12.60589003
## 41    variance 0.3260235 classif.naiveBayes              NA
## 42  anova.test 0.1792693 classif.naiveBayes              NA
## 43    variance 0.8352076 classif.naiveBayes              NA
## 44    variance 0.3050546        classif.svm    -11.25658081
## 45  anova.test 0.5568307 classif.naiveBayes              NA
## 46  anova.test 0.8657318        classif.svm     -7.33648205
## 47  anova.test 0.8001684 classif.naiveBayes              NA
## 48    variance 0.6070315 classif.naiveBayes              NA
## 49    variance 0.1328550        classif.svm     -4.02316001
## 50  anova.test 0.5172708 classif.naiveBayes              NA
## 51    variance 0.3729392 classif.naiveBayes              NA
## 52    variance 0.7601787        classif.svm     -8.26297934
## 53  anova.test 0.7107348 classif.naiveBayes              NA
## 54    variance 0.4574162        classif.svm      9.91584454
## 55  anova.test 0.4359611 classif.naiveBayes              NA
## 56  anova.test 0.9820834        classif.svm      5.04169978
## 57    variance 0.4068184 classif.naiveBayes              NA
## 58    variance 0.7096276 classif.naiveBayes              NA
## 59  anova.test 0.2291839        classif.svm    -14.95256557
## 60  anova.test 0.2066004        classif.svm    -13.14875740
## 61    variance 0.9605173 classif.naiveBayes              NA
## 62    variance 0.1135295        classif.svm     11.13815766
## 63  anova.test 0.9090443        classif.svm     -0.06016343
## 64    variance 0.6238896        classif.svm     -2.13017498
## 65  anova.test 0.8726609        classif.svm      8.67724099
## 66  anova.test 0.6702204 classif.naiveBayes              NA
## 67  anova.test 0.8704640        classif.svm      7.26979969
## 68  anova.test 0.9322867        classif.svm     -0.65913612
```

```
## 69  anova.test 0.6901154        classif.svm      -0.06885942
## 70  anova.test 0.4000320        classif.svm      -1.33589816
## 71  anova.test 0.4206982        classif.svm      -1.46465139
## 72  anova.test 0.1906051 classif.naiveBayes               NA
## 73  anova.test 0.3678421        classif.svm      -1.77606094
## 74    variance 0.1330533        classif.svm      10.11710850
## 75    variance 0.1444935        classif.svm      10.52725824
## 76    variance 0.1157433        classif.svm      11.52441448
## 77  anova.test 0.8390020        classif.svm       9.91656344
## 78  anova.test 0.6749075 classif.naiveBayes               NA
## 79  anova.test 0.5510641        classif.svm      -5.07149788
## 80    variance 0.3287561 classif.naiveBayes               NA
## 81  anova.test 0.5198455 classif.naiveBayes               NA
## 82    variance 0.1723876        classif.svm       7.55277797
## 83    variance 0.2753354 classif.naiveBayes               NA
## 84    variance 0.5097086 classif.naiveBayes               NA
## 85  anova.test 0.6920350 classif.naiveBayes               NA
## 86    variance 0.6095074        classif.svm     -14.18154942
## 87    variance 0.3848801 classif.naiveBayes               NA
## 88  anova.test 0.8566046        classif.svm      -0.50760775
## 89  anova.test 0.9938969 classif.naiveBayes               NA
## 90    variance 0.8855129        classif.svm     -11.91895466
## 91    variance 0.9301664        classif.svm     -10.91614653
## 92  anova.test 0.4695614        classif.svm       2.92721056
## 93    variance 0.2603116        classif.svm       1.26155373
## 94    variance 0.7680669        classif.svm      11.50923243
## 95  anova.test 0.3224051 classif.naiveBayes               NA
## 96  anova.test 0.7873439 classif.naiveBayes               NA
## 97  anova.test 0.1246889 classif.naiveBayes               NA
## 98    variance 0.6242448 classif.naiveBayes               NA
## 99    variance 0.1603947        classif.svm      -1.45138892
## 100   variance 0.7286349 classif.naiveBayes               NA
## 101 anova.test 0.2065178        classif.svm      13.24605739
## 102 anova.test 0.9565718        classif.svm      -7.22334491
## 103   variance 0.4418370 classif.naiveBayes               NA
## 104 anova.test 0.4207857        classif.svm      -8.46419351
## 105 anova.test 0.1314708 classif.naiveBayes               NA
## 106 anova.test 0.1182655 classif.naiveBayes               NA
## 107 anova.test 0.1312784 classif.naiveBayes               NA
## 108 anova.test 0.1254735 classif.naiveBayes               NA
## 109 anova.test 0.1274721 classif.naiveBayes               NA
## 110 anova.test 0.6744395        classif.svm      -3.20758968
## 111 anova.test 0.1257545 classif.naiveBayes               NA
## 112   variance 0.1252129 classif.naiveBayes               NA
## 113 anova.test 0.8581381        classif.svm      -4.06193793
## 114 anova.test 0.1249357 classif.naiveBayes               NA
##     classif.svm.gamma classif.svm.degree classif.svm.kernel mmce.test.mean
## 1                  NA                 NA               <NA>     0.01470588
## 2                  NA                  2         polynomial     0.73529412
## 3                  NA                 NA               <NA>     0.02941176
## 4                  NA                  4         polynomial     0.36764706
## 5                  NA                 NA               <NA>     0.02941176
## 6                  NA                 NA               <NA>     0.01470588
## 7                  NA                  2         polynomial     0.29411765
```

```
## 8                NA                NA              <NA>     0.01470588
## 9                NA                NA              <NA>     0.05882353
## 10               NA                 2        polynomial     0.32352941
## 11               NA                 3        polynomial     0.10294118
## 12               NA                NA              <NA>     0.01470588
## 13               NA                NA              <NA>     0.05882353
## 14               NA                NA              <NA>     0.08823529
## 15               NA                NA              <NA>     0.05882353
## 16               NA                NA              <NA>     0.01470588
## 17       -10.230289                NA            radial     0.57352941
## 18               NA                NA            linear     0.04411765
## 19               NA                NA            linear     0.73529412
## 20               NA                NA            linear     0.73529412
## 21               NA                NA              <NA>     0.02941176
## 22         8.718966                NA            radial     0.73529412
## 23        -5.996200                NA            radial     0.13235294
## 24               NA                NA            linear     0.07352941
## 25        14.586275                NA            radial     0.55882353
## 26               NA                NA              <NA>     0.05882353
## 27               NA                NA            linear     0.70588235
## 28               NA                NA              <NA>     0.01470588
## 29               NA                NA            linear     0.04411765
## 30               NA                NA              <NA>     0.72058824
## 31               NA                NA              <NA>     0.05882353
## 32               NA                NA              <NA>     0.05882353
## 33               NA                NA              <NA>     0.72058824
## 34               NA                NA              <NA>     0.05882353
## 35               NA                NA            linear     0.04411765
## 36               NA                NA            linear     0.02941176
## 37               NA                NA            linear     0.01470588
## 38               NA                NA              <NA>     0.05882353
## 39        -7.146925                NA            radial     0.64705882
## 40         1.791736                NA            radial     0.14705882
## 41               NA                NA              <NA>     0.07352941
## 42               NA                NA              <NA>     0.07352941
## 43               NA                NA              <NA>     0.07352941
## 44               NA                 4        polynomial     0.64705882
## 45               NA                NA              <NA>     0.07352941
## 46               NA                NA            linear     0.45588235
## 47               NA                NA              <NA>     0.07352941
## 48               NA                NA              <NA>     0.13235294
## 49               NA                 2        polynomial     0.36764706
## 50               NA                NA              <NA>     0.07352941
## 51               NA                NA              <NA>     0.07352941
## 52        -5.597059                NA            radial     0.64705882
## 53               NA                NA              <NA>     0.07352941
## 54               NA                 3        polynomial     0.10294118
## 55               NA                NA              <NA>     0.07352941
## 56        14.862071                NA            radial     0.63235294
## 57               NA                NA              <NA>     0.13235294
## 58               NA                NA              <NA>     0.07352941
## 59               NA                 4        polynomial     0.64705882
## 60               NA                NA            linear     0.64705882
## 61               NA                NA              <NA>     0.07352941
```

```
## 62                NA                NA            linear     0.64705882
## 63                NA                NA            linear     0.05882353
## 64         -14.895035                NA            radial     0.64705882
## 65                NA                NA            linear     0.05882353
## 66                NA                NA              <NA>     0.07352941
## 67                NA                NA            linear     0.05882353
## 68                NA                NA            linear     0.07352941
## 69                NA                NA            linear     0.05882353
## 70                NA                NA            linear     0.04411765
## 71                NA                NA            linear     0.04411765
## 72                NA                NA              <NA>     0.07352941
## 73                NA                NA            linear     0.08823529
## 74                NA                NA            linear     0.08823529
## 75                NA                NA            linear     0.08823529
## 76                NA                NA            linear     0.76470588
## 77          1.272884                NA            radial     0.02941176
## 78                NA                NA              <NA>     0.04411765
## 79          2.779093                NA            radial     0.32352941
## 80                NA                NA              <NA>     0.05882353
## 81                NA                NA              <NA>     0.00000000
## 82                NA                 4        polynomial     0.17647059
## 83                NA                NA              <NA>     0.05882353
## 84                NA                NA              <NA>     0.08823529
## 85                NA                NA              <NA>     0.04411765
## 86                NA                 2        polynomial     0.58823529
## 87                NA                NA              <NA>     0.08823529
## 88                NA                 3        polynomial     0.10294118
## 89                NA                NA              <NA>     0.04411765
## 90          14.486075                NA            radial     0.67647059
## 91                NA                NA            linear     0.39705882
## 92                NA                NA            linear     0.01470588
## 93          9.087509                NA            radial     0.08823529
## 94                NA                NA            linear     0.02941176
## 95                NA                NA              <NA>     0.05882353
## 96                NA                NA              <NA>     0.04411765
## 97                NA                NA              <NA>     0.66176471
## 98                NA                NA              <NA>     0.08823529
## 99                NA                 1        polynomial     0.05882353
## 100               NA                NA              <NA>     0.04411765
## 101        -10.457179                NA            radial     0.04411765
## 102         -1.022893                NA            radial     0.35294118
## 103               NA                NA              <NA>     0.08823529
## 104               NA                 4        polynomial     0.58823529
## 105               NA                NA              <NA>     0.05882353
## 106               NA                NA              <NA>     0.66176471
## 107               NA                NA              <NA>     0.05882353
## 108               NA                NA              <NA>     0.05882353
## 109               NA                NA              <NA>     0.05882353
## 110               NA                 1        polynomial     0.04411765
## 111               NA                NA              <NA>     0.05882353
## 112               NA                NA              <NA>     0.05882353
## 113               NA                 1        polynomial     0.08823529
## 114               NA                NA              <NA>     0.61764706
##     dob eol error.message exec.time iter
```

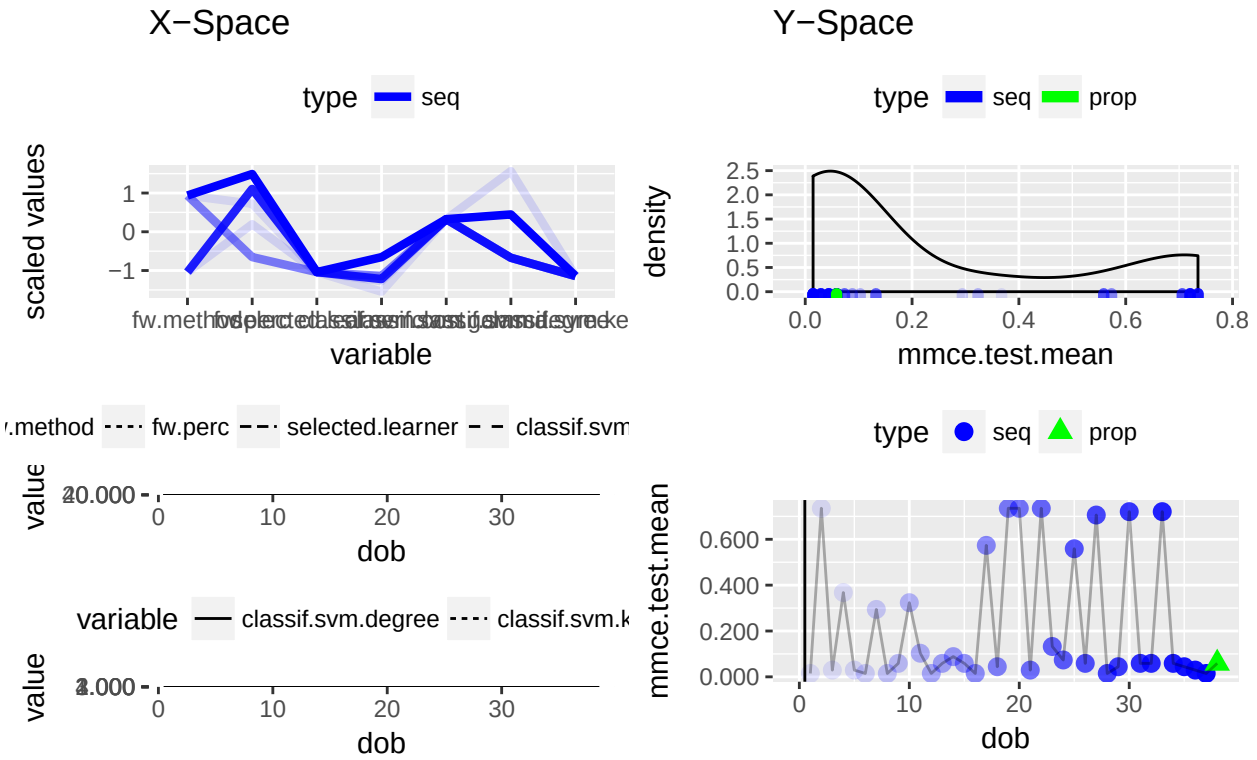
```
##    1     1  NA          <NA>     0.116    1
##    2     2  NA          <NA>     0.303    1
##    3     3  NA          <NA>     0.076    1
##    4     4  NA          <NA>     0.038    1
##    5     5  NA          <NA>     0.039    1
##    6     6  NA          <NA>     0.040    1
##    7     7  NA          <NA>     0.042    1
##    8     8  NA          <NA>     0.040    1
##    9     9  NA          <NA>     0.038    1
##   10    10  NA          <NA>     0.038    1
##   11    11  NA          <NA>     0.038    1
##   12    12  NA          <NA>     0.041    1
##   13    13  NA          <NA>     0.037    1
##   14    14  NA          <NA>     0.038    1
##   15    15  NA          <NA>     0.037    1
##   16    16  NA          <NA>     0.046    1
##   17    17  NA          <NA>     0.036    1
##   18    18  NA          <NA>     0.038    1
##   19    19  NA          <NA>     0.039    1
##   20    20  NA          <NA>     0.041    1
##   21    21  NA          <NA>     0.045    1
##   22    22  NA          <NA>     0.040    1
##   23    23  NA          <NA>     0.037    1
##   24    24  NA          <NA>     0.040    1
##   25    25  NA          <NA>     0.038    1
##   26    26  NA          <NA>     0.040    1
##   27    27  NA          <NA>     0.023    1
##   28    28  NA          <NA>     0.039    1
##   29    29  NA          <NA>     0.037    1
##   30    30  NA          <NA>     0.022    1
##   31    31  NA          <NA>     0.035    1
##   32    32  NA          <NA>     0.036    1
##   33    33  NA          <NA>     0.022    1
##   34    34  NA          <NA>     0.036    1
##   35    35  NA          <NA>     0.040    1
##   36    36  NA          <NA>     0.038    1
##   37    37  NA          <NA>     0.037    1
##   38    38  NA          <NA>     0.038    1
##   39     1  NA          <NA>     0.046    2
##   40     2  NA          <NA>     0.037    2
##   41     3  NA          <NA>     0.036    2
##   42     4  NA          <NA>     0.036    2
##   43     5  NA          <NA>     0.040    2
##   44     6  NA          <NA>     0.041    2
##   45     7  NA          <NA>     0.042    2
##   46     8  NA          <NA>     0.038    2
##   47     9  NA          <NA>     0.040    2
##   48    10  NA          <NA>     0.039    2
##   49    11  NA          <NA>     0.040    2
##   50    12  NA          <NA>     0.038    2
##   51    13  NA          <NA>     0.036    2
##   52    14  NA          <NA>     0.038    2
##   53    15  NA          <NA>     0.040    2
##   54    16  NA          <NA>     0.037    2
```

```
## 55   17  NA          <NA>     0.039    2
## 56   18  NA          <NA>     0.040    2
## 57   19  NA          <NA>     0.038    2
## 58   20  NA          <NA>     0.044    2
## 59   21  NA          <NA>     0.037    2
## 60   22  NA          <NA>     0.036    2
## 61   23  NA          <NA>     0.040    2
## 62   24  NA          <NA>     0.022    2
## 63   25  NA          <NA>     0.041    2
## 64   26  NA          <NA>     0.037    2
## 65   27  NA          <NA>     0.037    2
## 66   28  NA          <NA>     0.041    2
## 67   29  NA          <NA>     0.038    2
## 68   30  NA          <NA>     0.038    2
## 69   31  NA          <NA>     0.037    2
## 70   32  NA          <NA>     0.037    2
## 71   33  NA          <NA>     0.036    2
## 72   34  NA          <NA>     0.037    2
## 73   35  NA          <NA>     0.036    2
## 74   36  NA          <NA>     0.035    2
## 75   37  NA          <NA>     0.036    2
## 76   38  NA          <NA>     0.024    2
## 77    1  NA          <NA>     0.044    3
## 78    2  NA          <NA>     0.039    3
## 79    3  NA          <NA>     0.038    3
## 80    4  NA          <NA>     0.036    3
## 81    5  NA          <NA>     0.039    3
## 82    6  NA          <NA>     0.044    3
## 83    7  NA          <NA>     0.037    3
## 84    8  NA          <NA>     0.039    3
## 85    9  NA          <NA>     0.040    3
## 86   10  NA          <NA>     0.038    3
## 87   11  NA          <NA>     0.041    3
## 88   12  NA          <NA>     0.038    3
## 89   13  NA          <NA>     0.041    3
## 90   14  NA          <NA>     0.038    3
## 91   15  NA          <NA>     0.041    3
## 92   16  NA          <NA>     0.037    3
## 93   17  NA          <NA>     0.037    3
## 94   18  NA          <NA>     0.036    3
## 95   19  NA          <NA>     0.037    3
## 96   20  NA          <NA>     0.043    3
## 97   21  NA          <NA>     0.022    3
## 98   22  NA          <NA>     0.038    3
## 99   23  NA          <NA>     0.036    3
## 100  24  NA          <NA>     0.040    3
## 101  25  NA          <NA>     0.040    3
## 102  26  NA          <NA>     0.039    3
## 103  27  NA          <NA>     0.038    3
## 104  28  NA          <NA>     0.038    3
## 105  29  NA          <NA>     0.037    3
## 106  30  NA          <NA>     0.022    3
## 107  31  NA          <NA>     0.039    3
## 108  32  NA          <NA>     0.037    3
```

```
## 109  33  NA          <NA>      0.036    3
## 110  34  NA          <NA>      0.038    3
## 111  35  NA          <NA>      0.037    3
## 112  36  NA          <NA>      0.038    3
## 113  37  NA          <NA>      0.038    3
## 114  38  NA          <NA>      0.023    3
```

```
plotOptPath(res$extract[[1]]$opt.path)
```

```
## Warning in multiVariablesOverTime(op = cbind(op.x, op.rest), .alpha
## = .alpha, : Converting variable fw.method to numeric for over time plot.

## Warning in multiVariablesOverTime(op = cbind(op.x, op.rest), .alpha
## = .alpha, : Converting variable selected.learner to numeric for over time
## plot.

## Warning in multiVariablesOverTime(op = cbind(op.x, op.rest), .alpha
## = .alpha, : Converting variable classif.svm.kernel to numeric for over time
## plot.

## Warning: Removed 33 rows containing missing values (geom_point).

## Warning: Removed 28 rows containing missing values (geom_path).
```



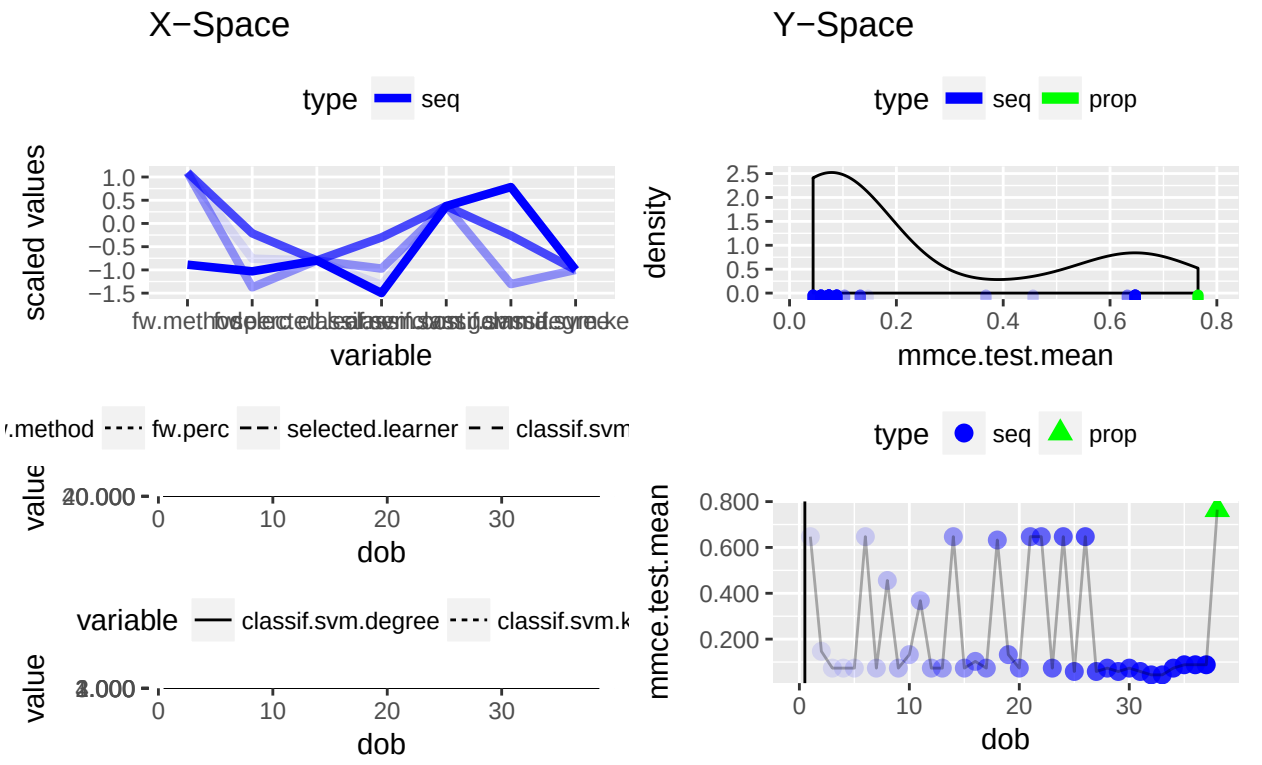

```
plotOptPath(res$extract[[2]]$opt.path)
```

```
## Warning in multiVariablesOverTime(op = cbind(op.x, op.rest), .alpha
## = .alpha, : Converting variable fw.method to numeric for over time plot.

## Warning in multiVariablesOverTime(op = cbind(op.x, op.rest), .alpha
## = .alpha, : Converting variable selected.learner to numeric for over time
## plot.

## Warning in multiVariablesOverTime(op = cbind(op.x, op.rest), .alpha
```

```
## = .alpha, : Converting variable classif.svm.kernel to numeric for over time
## plot.
```

```
## Warning: Removed 34 rows containing missing values (geom_point).
```

```
## Warning: Removed 22 rows containing missing values (geom_path).
```




```
plotOptPath(res$extract[[3]]$opt.path)
```

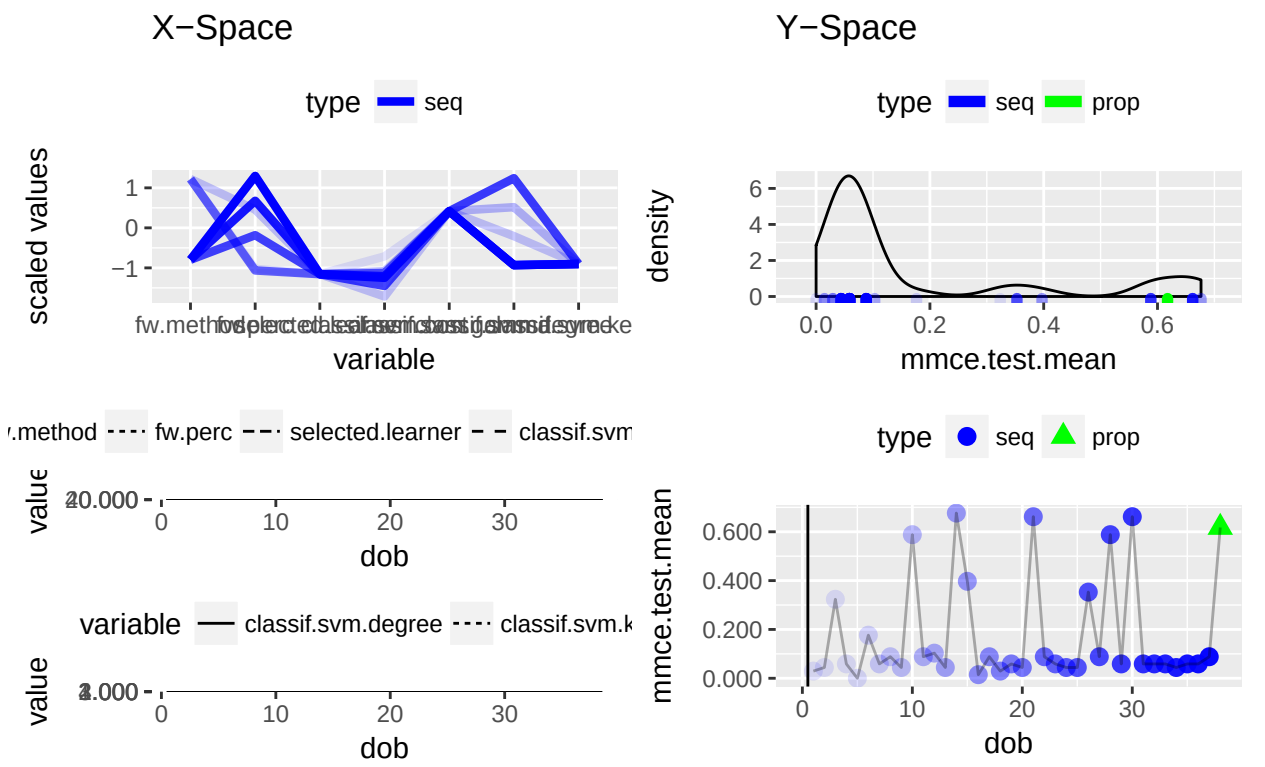
```
## Warning in multiVariablesOverTime(op = cbind(op.x, op.rest), .alpha
## = .alpha, : Converting variable fw.method to numeric for over time plot.
```

```
## Warning in multiVariablesOverTime(op = cbind(op.x, op.rest), .alpha
## = .alpha, : Converting variable selected.learner to numeric for over time
## plot.
```

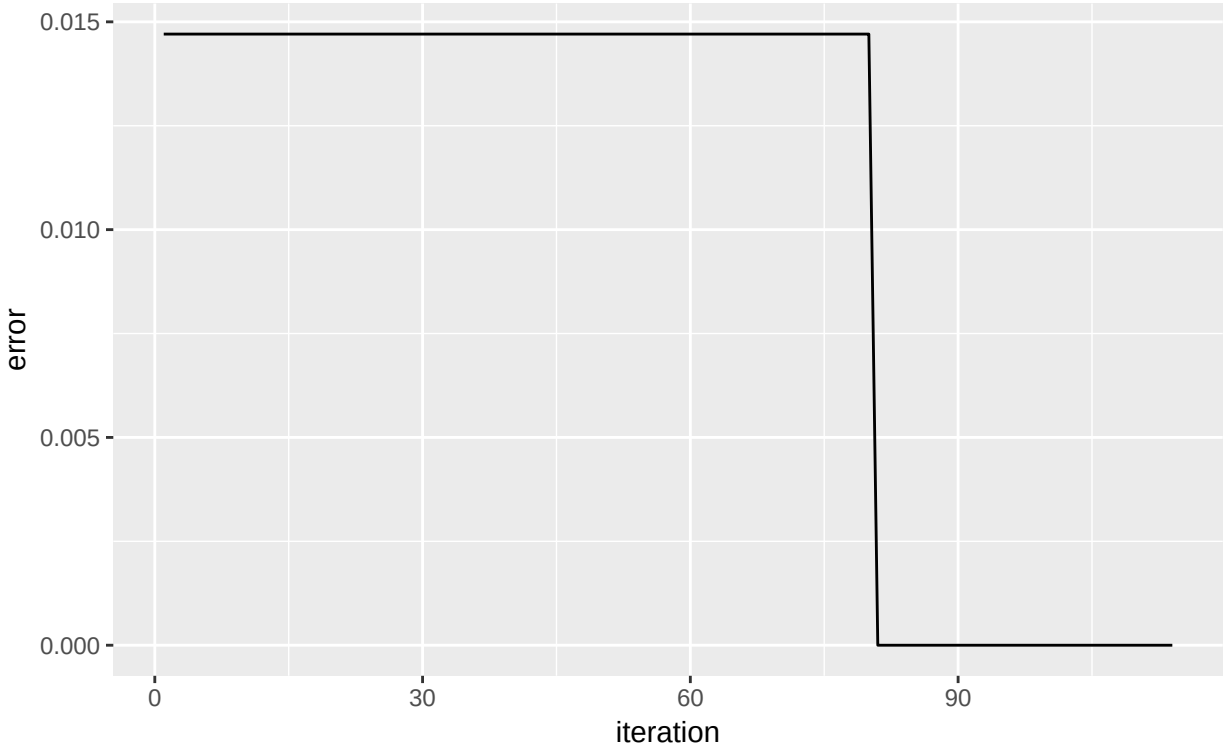
```
## Warning in multiVariablesOverTime(op = cbind(op.x, op.rest), .alpha
## = .alpha, : Converting variable classif.svm.kernel to numeric for over time
## plot.
```

```
## Warning: Removed 31 rows containing missing values (geom_point).
```

```
## Warning: Removed 6 rows containing missing values (geom_path).
```




```
ggplot(opt.paths, aes(x = 1:nrow(opt.paths), y = cummin(mmce.test.mean))) +
    geom_line() + ylab("error") + xlab("iteration")
```




```
best = getNestedTuneResultsX(res)
best
```

```
##    fw.method   fw.perc   selected.learner classif.svm.cost
```

```
## 1   variance 0.7365471 classif.naiveBayes               NA
## 2 anova.test 0.4000320        classif.svm        0.3961454
## 3 anova.test 0.5198455 classif.naiveBayes               NA
##   classif.svm.kernel
## 1               <NA>
## 2             linear
## 3               <NA>
```