Spatial model

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```
library(tinyVAST)
library(pdp)  # approx = TRUE gives effects for average of other covariates
library(lattice)
library(visreg)
library(fmesher)
set.seed(101)
```

`tinyVAST` is an R package for fitting vector autoregressive spatio-temporal (VAST) models using a minimal and user-friendly interface. We here show how it can fit spatial structural equation models

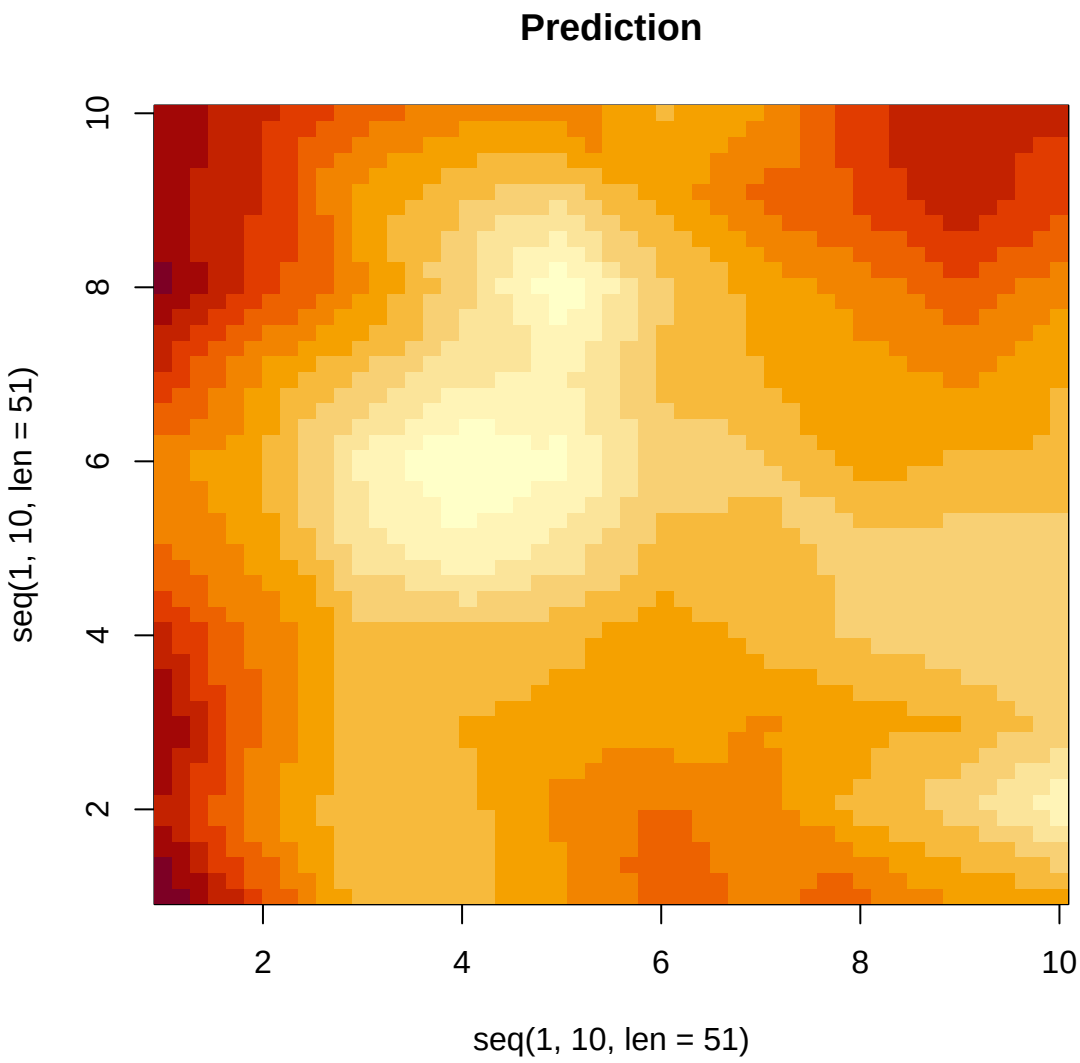
```
# Simulate
R = exp(-0.4 * abs(outer(1:10, 1:10, FUN="-")) )
z = mvtnorm::rmvnorm(1, sigma=kronecker(R,R) )
t = sample(1:10, replace=TRUE, size=length(z))
Data = data.frame( expand.grid(x=1:10, y=1:10), t=t, z=as.vector(z) + cos(t/10*2*pi))
Data$n = Data$z + rnorm(nrow(Data), sd=1)

# Add columns for multivariate and temporal dimensions
Data$time = 1
Data$var = "n"

# make mesh
mesh = fm_mesh_2d( Data[,c('x','y')] )

# fit model
out = fit( data = Data,
           formula = n ~ s(t),
           spatial_graph = mesh,
           quiet = TRUE,
           sem = "" )
```

`tinyVAST` then has a standard `predict` function:

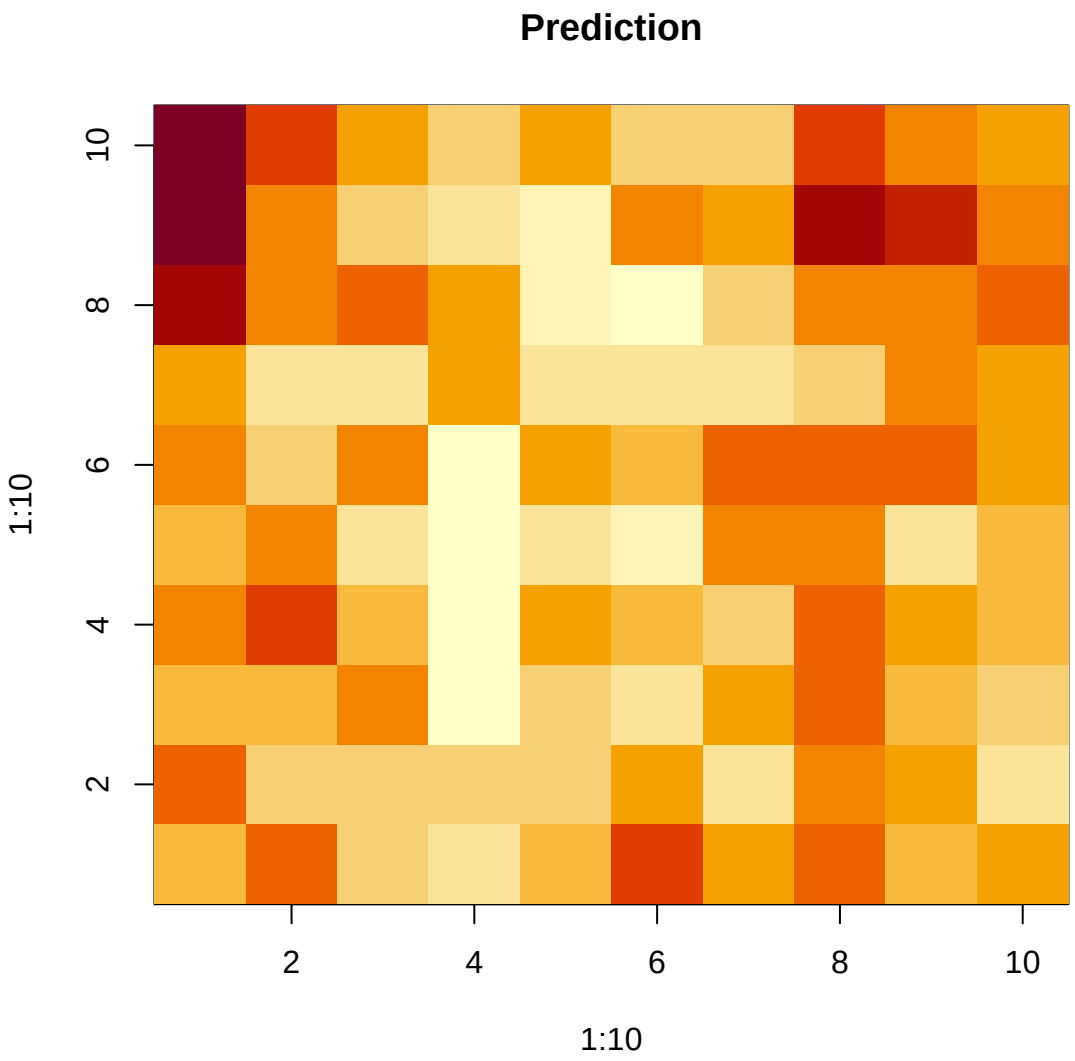
```
predict(out, newdata=data.frame(x=1, y=1, time=1, t=1, var="n") )
#> [1] 2.799474
```

and this is used to compute the spatial response

```
# Prediction grid
pred = outer( seq(1,10,len=51),
              seq(1,10,len=51),
              FUN=\(x,y) predict(out,newdata=data.frame(x=x,y=y,t=1,time=1,var="n")) )
image( x=seq(1,10,len=51), y=seq(1,10,len=51), z=pred, main="Prediction" )
```

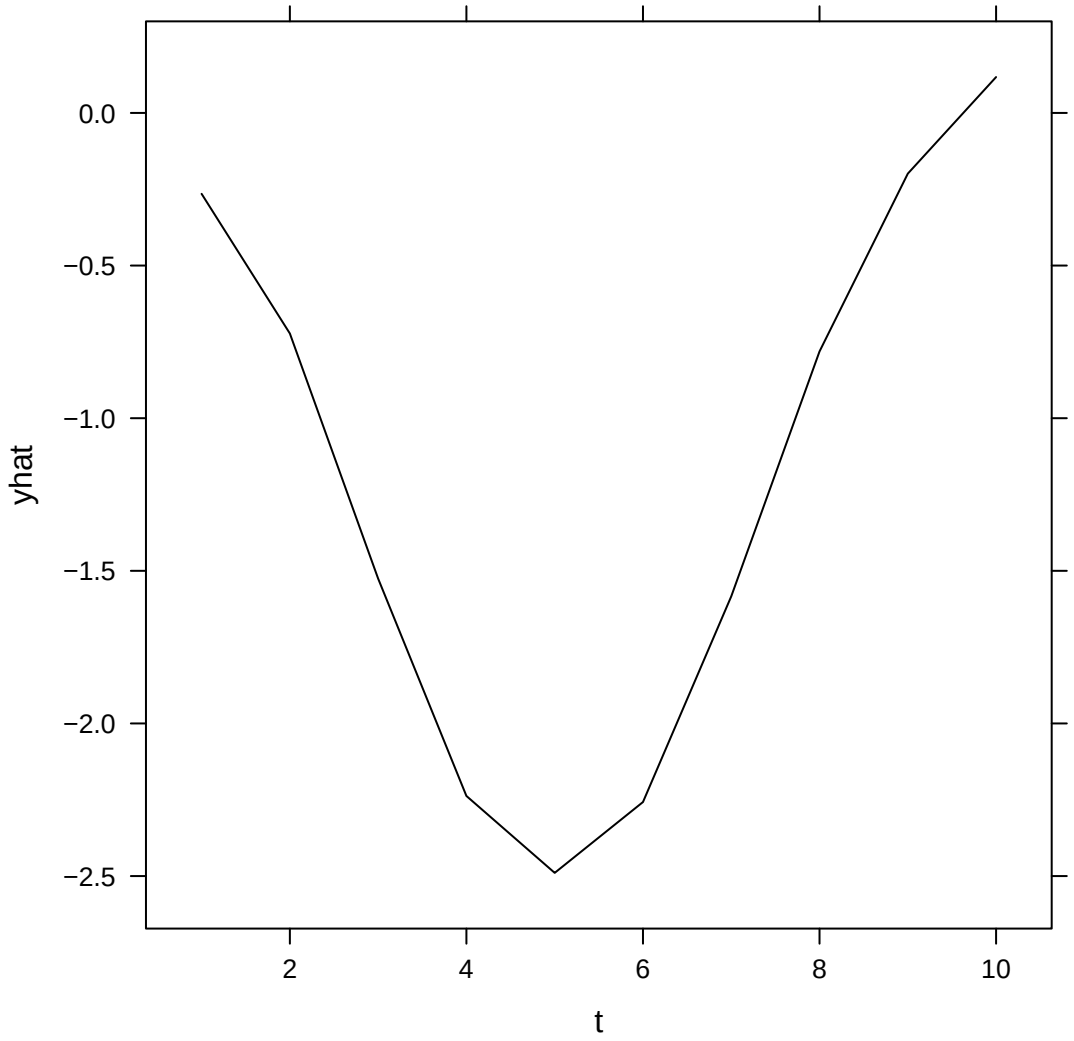



```
# True value
image( x=1:10, y=1:10, z=matrix(Data$z,ncol=10), main="Prediction" )
```



We can also compute the marginal time effect

```
# compute partial dependence plot
Partial = partial( object = out,
                   pred.var = "t",
                   pred.fun = \(object,newdata) predict(object,newdata),
                   train = Data,
                   approx = TRUE )

# Lattice plots as default option
plotPartial( Partial )
```


0.0
−0.5
−1.0
−1.5
−2.0
−2.5
yhat
2
4
6
8
10
t