College Data

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Packages:

```r
# install the development version of vivid:
#devtools::install_github("AlanInglis/vivid")

# Load relevant packages:
if(!require(network)){
    install.packages("network")
}
if(!require(sp)){
    install.packages("sp")
}
library("vivid") # for visualisations
library("ISLR") # for data
library("mlr3") # to create model
library("mlr3learners") # to create model
library("randomForest") # to create model
library("condvis2") # for predict function
library("kknn") # to get knn model
library("dplyr")
```

Read in and setup data:

```r
# Load data:
collegeData <- College

# Taking log values of skewed data:
collegeData <- collegeData %>%
  mutate(log(collegeData[,c(2:4,7:12)]))


# Split data into train and test
set.seed(101)
train <- sample(nrow(collegeData), round(.7*nrow(collegeData))) # split 70-30
collegeTrain <- collegeData[train, ]
collegeTest <- collegeData[-train, ]
xTest <- collegeTest[,-4]
yTest <- collegeTest$Enroll
```

Model fitting:

Fit a random forest an k-nearest neighbor models

```
# Fit a random forest model
# Used throughout Section 2:
set.seed(101)
rf <- randomForest(Enroll ~ ., data = collegeTrain)

# Check mse for rf model:
predRf <- predict(rf, newdata = collegeTest)
mspeRf <- mean((yTest - predRf)^2)
Rsq <- 1 - sum((yTest - predRf)^2)/sum((yTest - mean(yTest))^2)
Rsq
```

```
## [1] 0.9623167
```

```
mspeRf
```

```
## [1] 0.03424027
```

```
# Fit an mlr3 knn model
# Used in Section 2.3:
knnT <- TaskRegr$new(id = "knn", backend = collegeTrain, target = "Enroll")
knnL <- lrn("regr.kknn")
knnMod <- knnL$train(knnT)


# Check mse for knn model:
pred <- predict(knnMod, newdata = collegeTest)
mspe <- mean((yTest - pred)^2)
mspe
```

```
## [1] 0.1031804
```

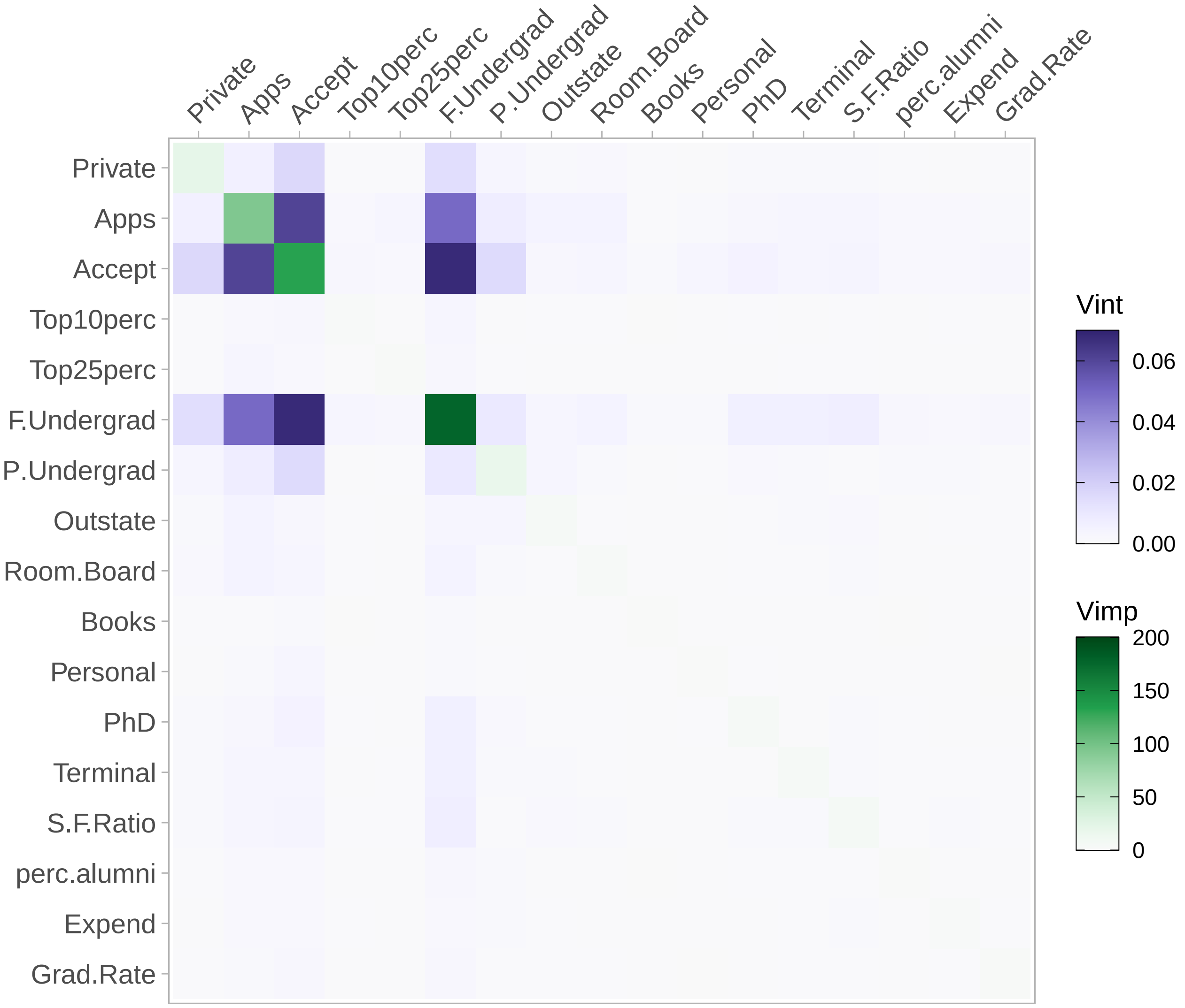
Create vivid matrix

```
# Create unsorted vivid matrix for random forest fit:
# Used for Figure 1(a):
set.seed(101)
vividMatrixRF <- vivi(collegeTrain,
                      rf, "Enroll",
                      gridSize = 20,
                      reorder = FALSE)

# Sort matrix:
# Used for Figure 1(b):
vividMatrixRFSorted <- vividReorder(vividMatrixRF)

# Get agnostic VImp values instead of using random forests embedded VImps
# Used for Figure 2(b):
collegeVImps <- vivid:::vividImportance.default(rf,
  collegeTrain,
  "Enroll",
  importanceType = "agnostic",
  predictFun = CVpredict
)

# Update the matrix with the new VImp values and sort:
vividMatrixRFSorted_1 <- viviUpdate(vividMatrixRFSorted, collegeVImps)
vividMatrixRFSorted_1 <- vividReorder(vividMatrixRFSorted_1)

# Create vivid matrix for mlr3 knn fit using agnostic VImp
# Used for Figure 2(a):
set.seed(101)
knnMat <- vivi(
  fit = knnMod,
  data = collegeTrain,
  response = "Enroll",
  gridSize = 20,
  importanceType = "agnostic"
)
```

Visualisations for Section 2

Figure 1(a) & 1(b):

```
# Figure 1(a):
viviHeatmap(vividMatrixRF, angle = 45) # unsorted heatmap
# Figure 1(b):
viviHeatmap(vividMatrixRFSorted, angle = 45) # sorted heatmap
```


Private
Apps
Accept
Top10perc
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F.Undergrad
P.Undergrad
Outstate
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Terminal
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Grad.Rate
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0.06
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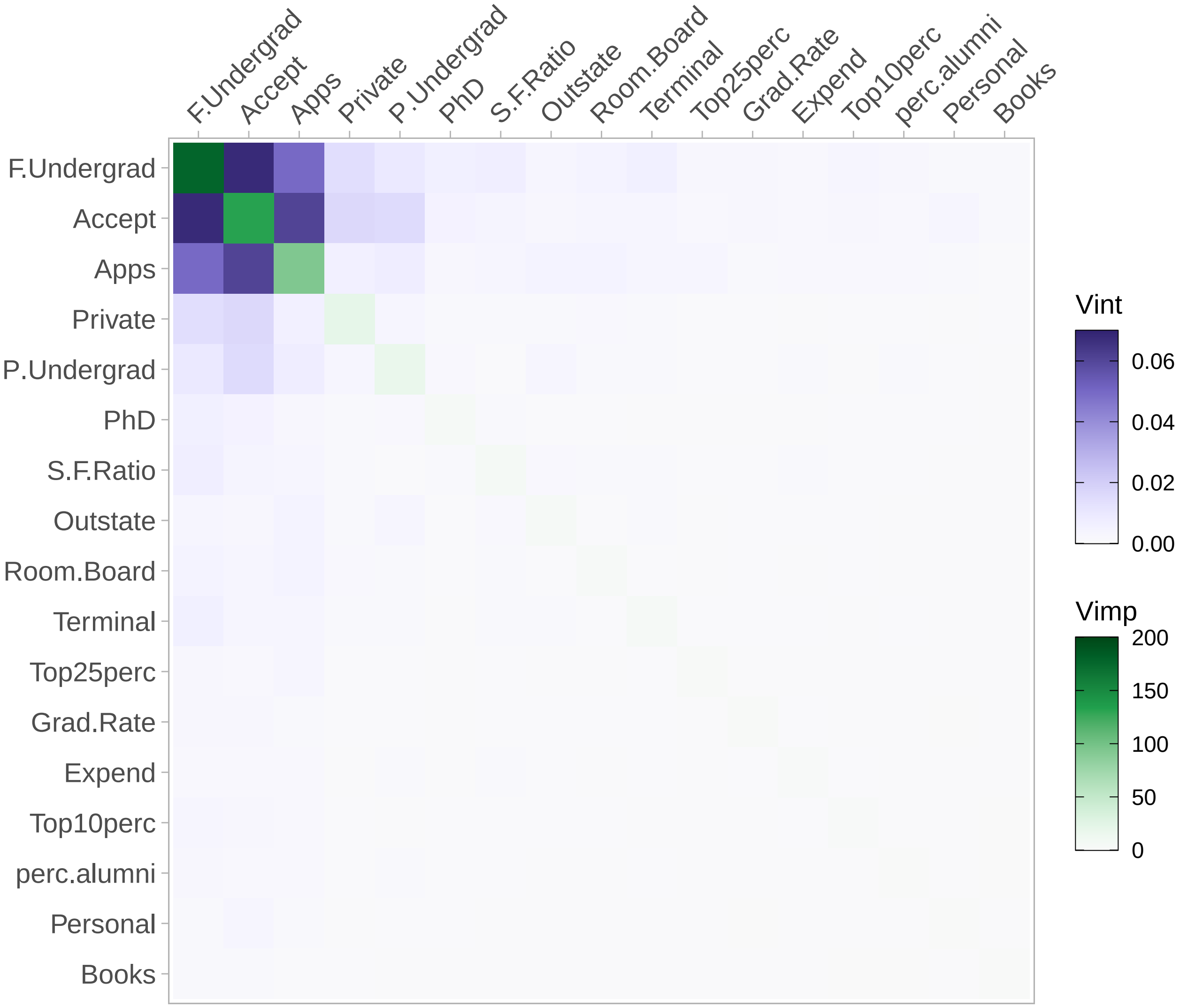
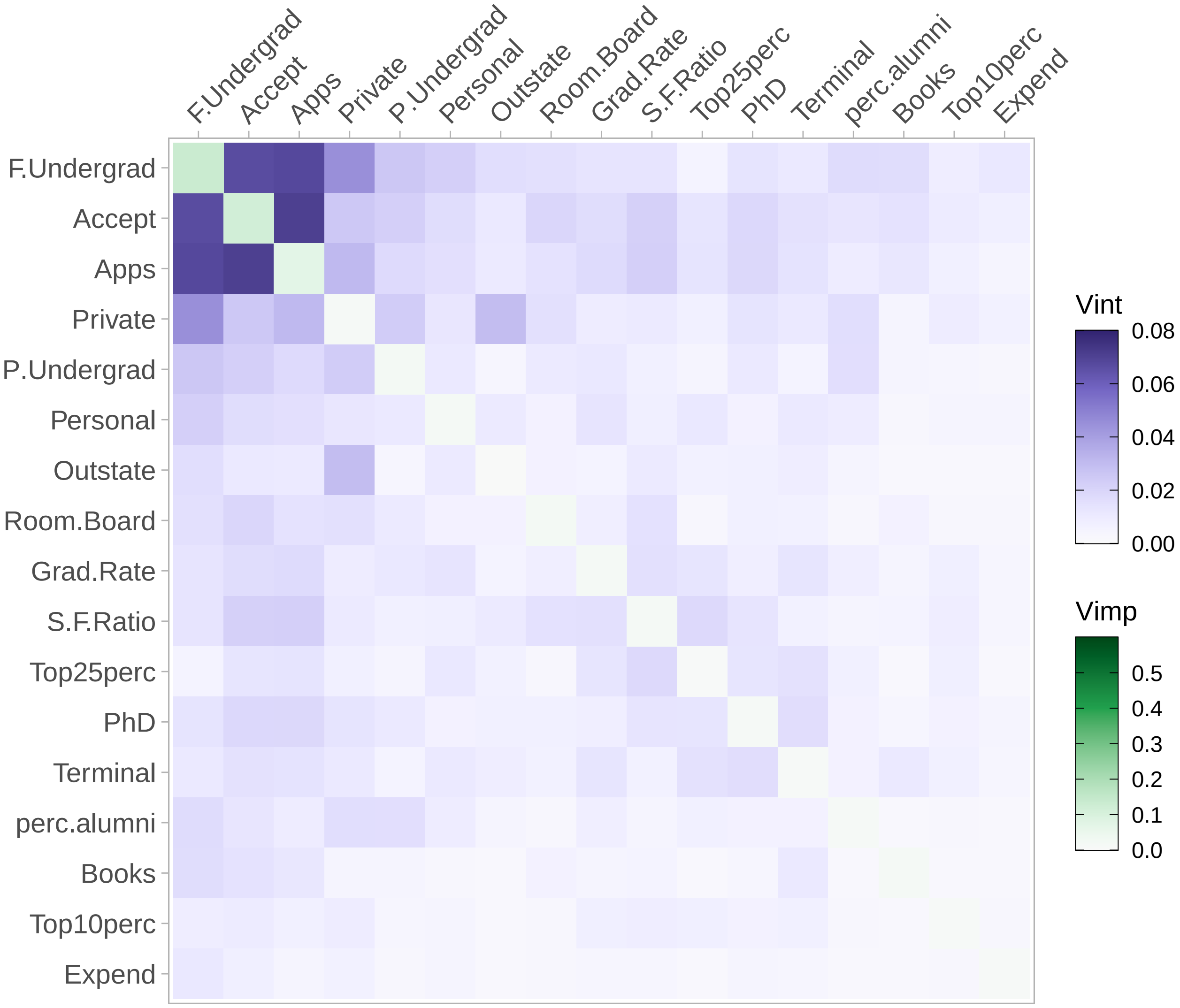


Figure 2(a) & 2(b):

```
# Figure 2(a):
viviHeatmap(knnMat, angle = 45, impLims = c(0, 0.6), intLims = c(0, 0.08)) # setting same VImp limits a
# Figure 2(b)
viviHeatmap(vividMatrixRFSorted_1, angle = 45, impLims = c(0, 0.6), intLims = c(0, 0.08)) # agnostic VI
```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P.Undergrad
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PhD
Terminal
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Books
Top10perc
Expend
Vint
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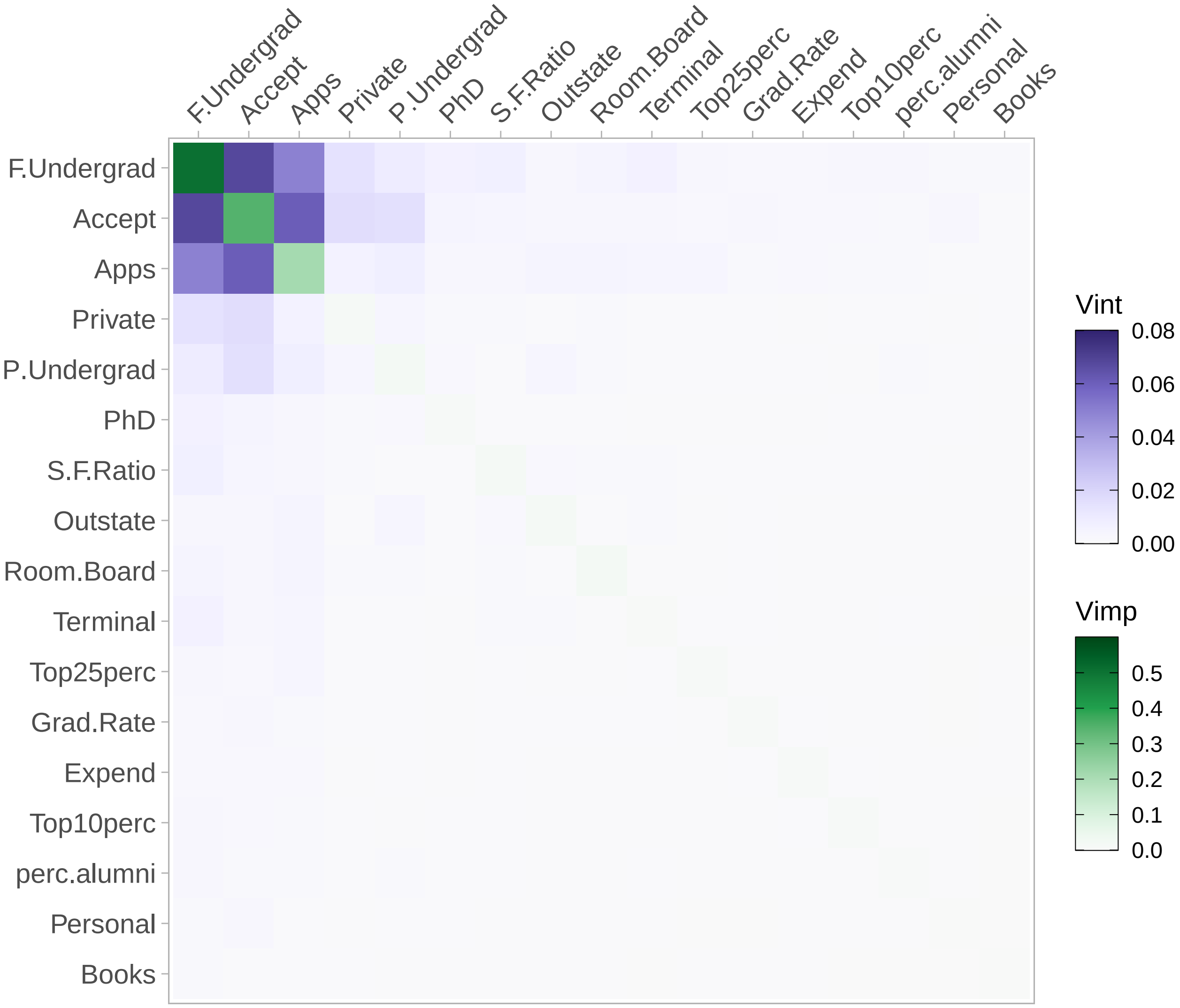
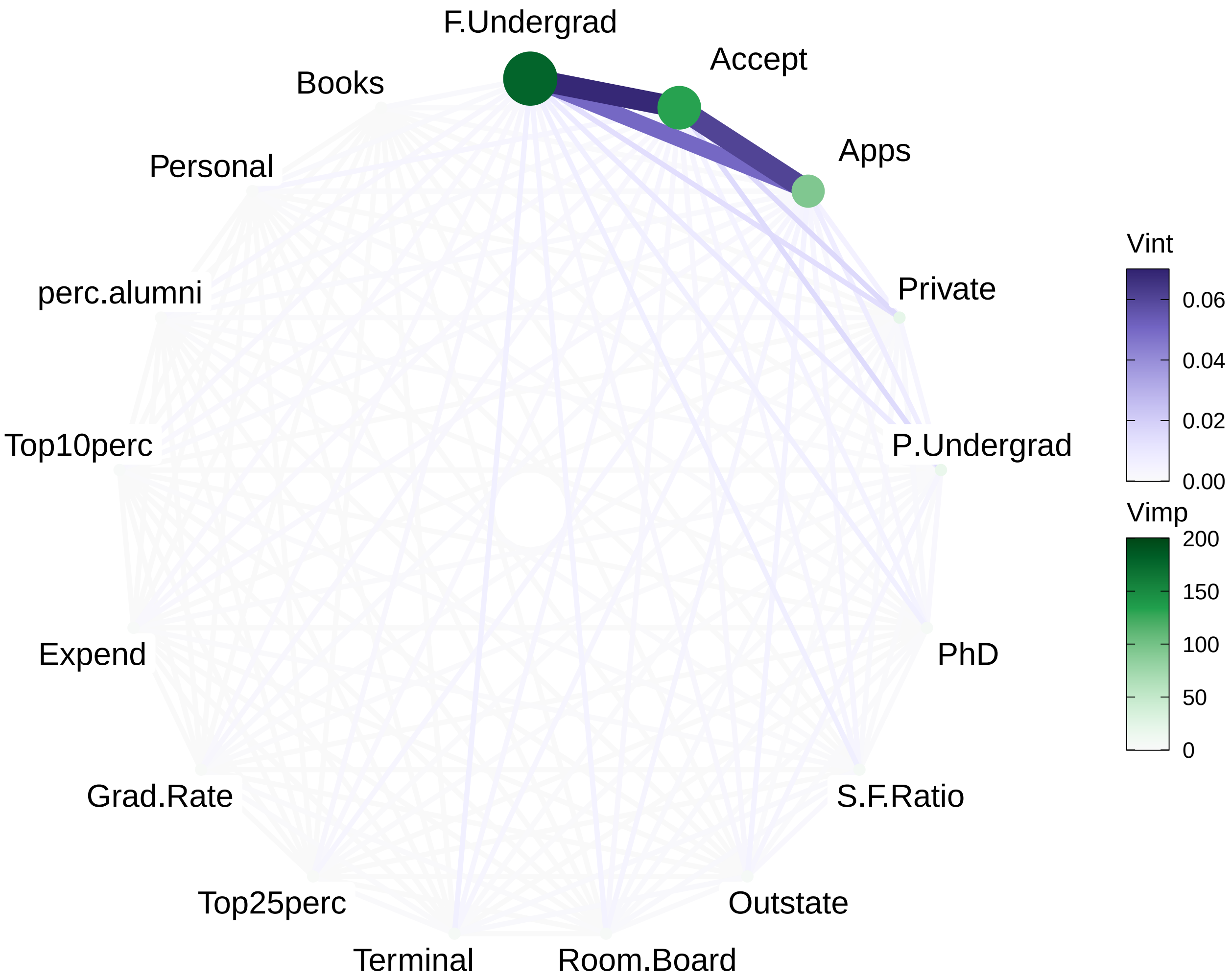


Figure 3(a) & 3(b):

```
# Figure 3(a)
viviNetwork(vividMatrixRFSorted)
# Figure 3(b)
intVals <- as.dist(vividMatrixRFSorted)
intVals <- as.matrix(intVals)
sv <- which(diag(vividMatrixRFSorted) > 50 |apply(intVals, 1,max) > .01)
h <- hclust(-as.dist(vividMatrixRFSorted[sv,sv]), method="single")
viviNetwork(vividMatrixRFSorted[sv,sv],
            intThreshold = 0.01,
            removeNode = T,
            cluster = cutree(h,3))
```


F.Undergrad
Accept
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Top10perc
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S.F.Ratio
Top25perc
Outstate
Terminal
Room.Board
Vint
0.06
0.04
0.02
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Vimp
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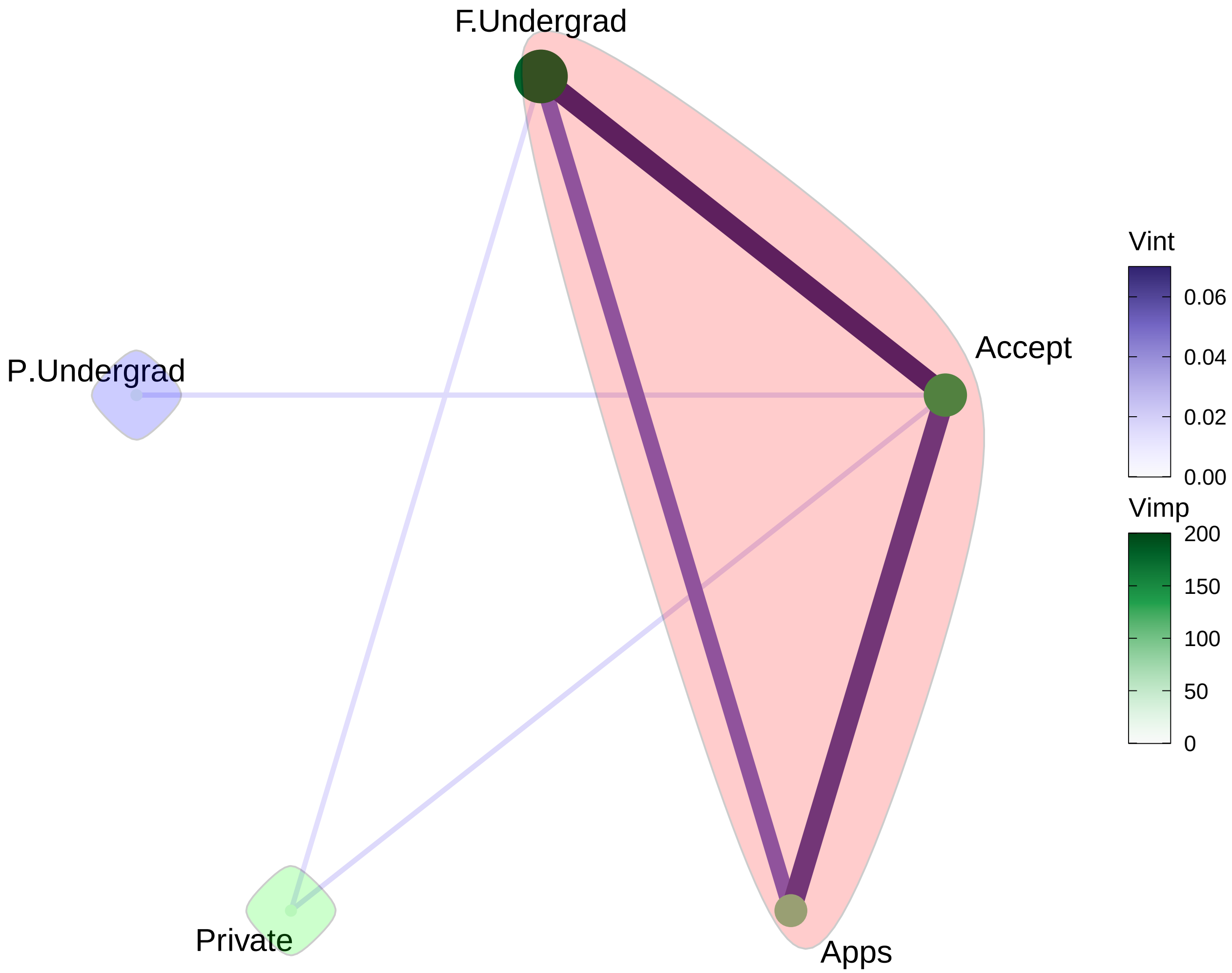
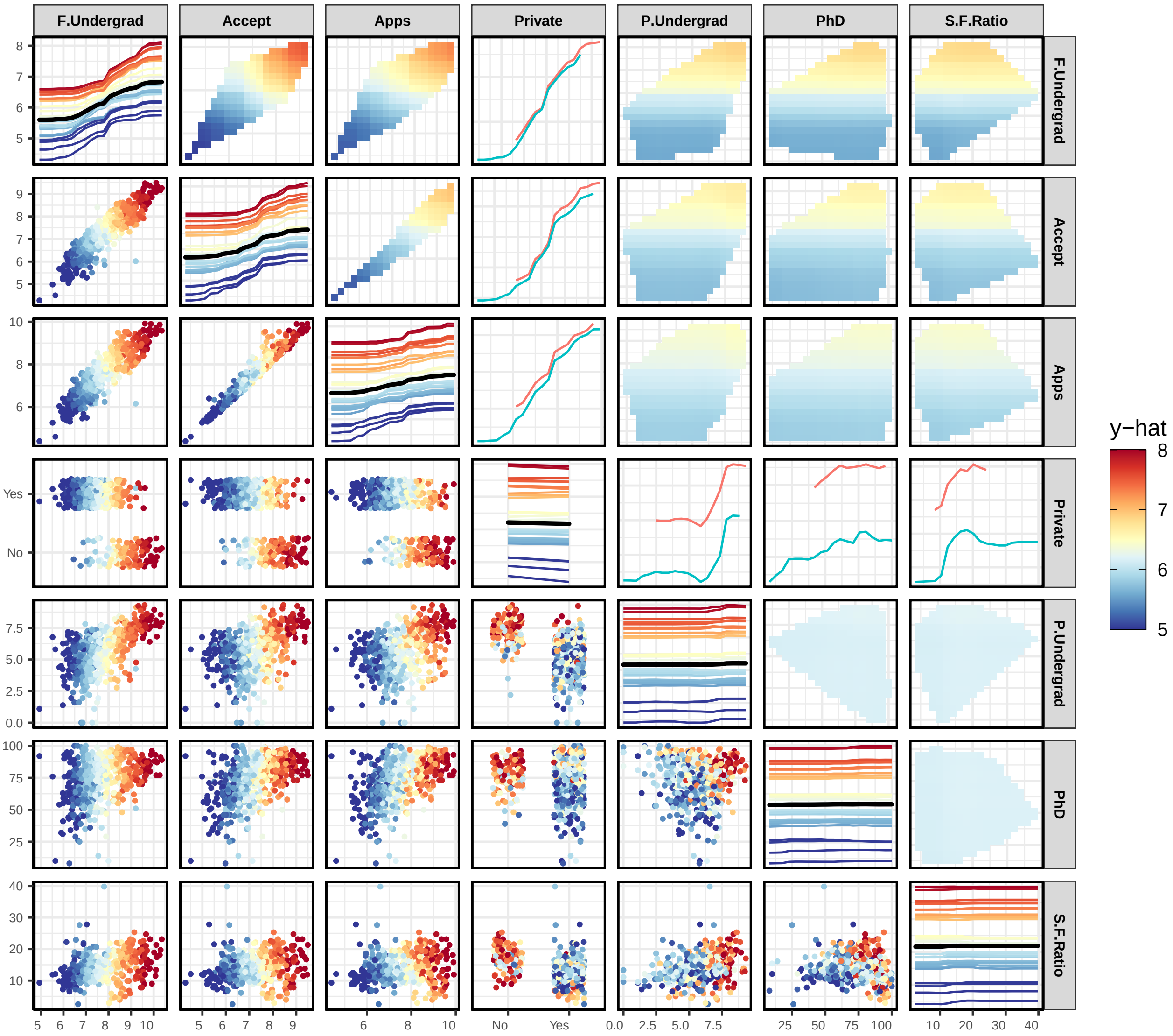


Visualisation for Section 3.2

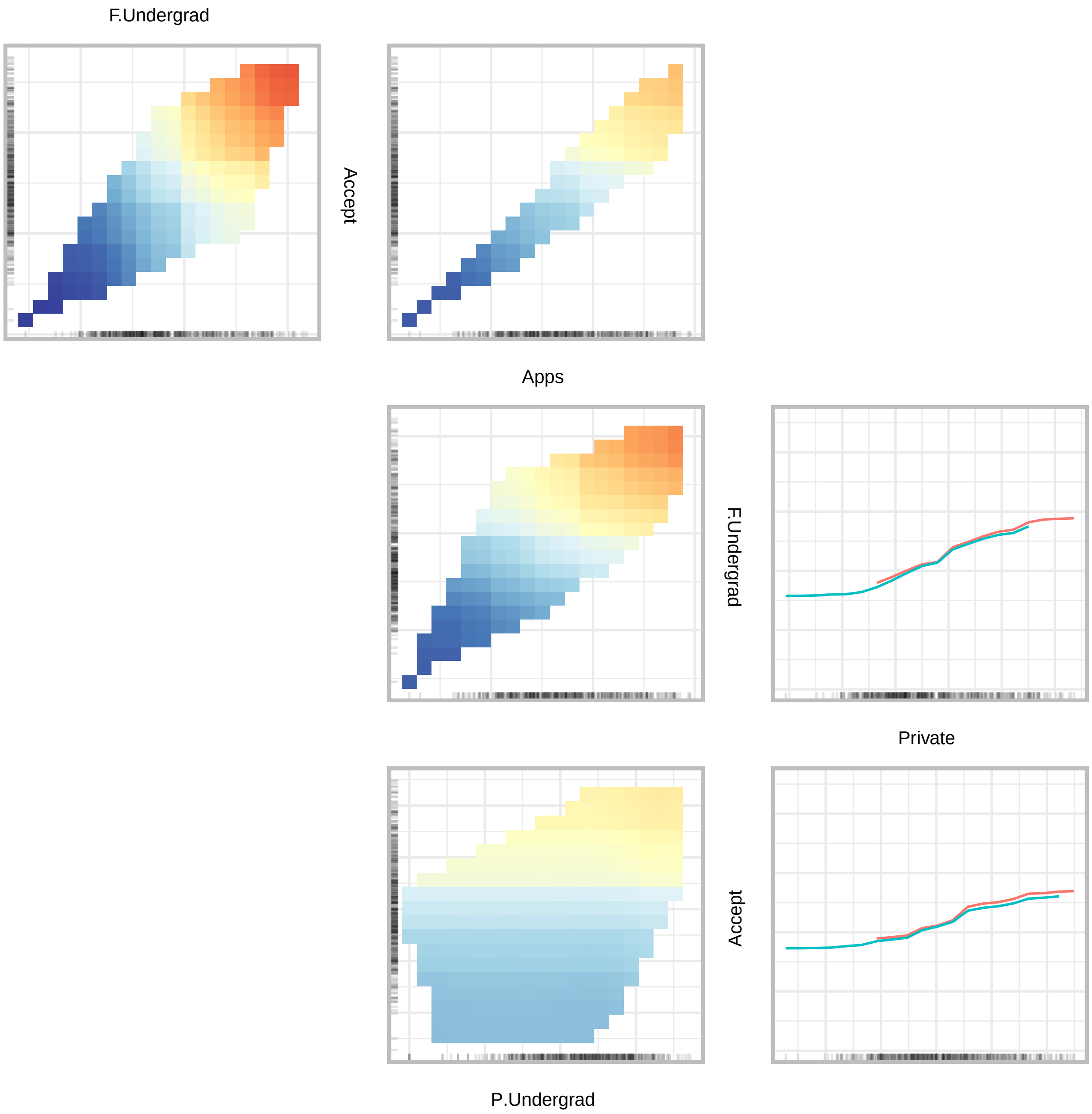
Figure 4:

```
# Filter matrix:
nam <- colnames(vividMatrixRFSorted) # get names
nam <- nam[1:7] # filter names

# Create GPDP for Figure 4:
set.seed(101)
pdpPairs(collegeTrain,
  rf, "Enroll",
  gridSize = 20,
  vars = nam,
  convexHull = TRUE
)
```



Visualisation for Section 3.3

```
# Calculate the zpath using same threshold as Figure 3(b):
zpath <- zPath(vividMatrixRFSorted, 0.01)

# Create ZPDP using zpath for Figure 5:
set.seed(101)
pdpZen(collegeTrain,
  rf,
  "Enroll",
  gridSize = 20,
  zpath = zpath,
  convexHull = T
)
```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Apps
F.Undergrad
Private
Accept
P.Undergrad