Data Science Campus

Coffee and Coding Session: Intermediate Level

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Data Science Campus

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Chapter 1 – Data Preparation

Please follow:

https://rb.gy/n6yaja

Chapter 2 – Regression

Please follow:

https://rb.gy/ub4nxu

Chapter 3 – Classification

Please follow:

https://rb.gy/whnkbh

Deeper dive into Decision Trees

- Tree structured Classifier, used for Classification problems & Regression
- Branches, Decision Nodes and Leaf Nodes

Measure used to split a node:

To reduce Classification error

Gini:

- measure of impurity in a node
- Information gain

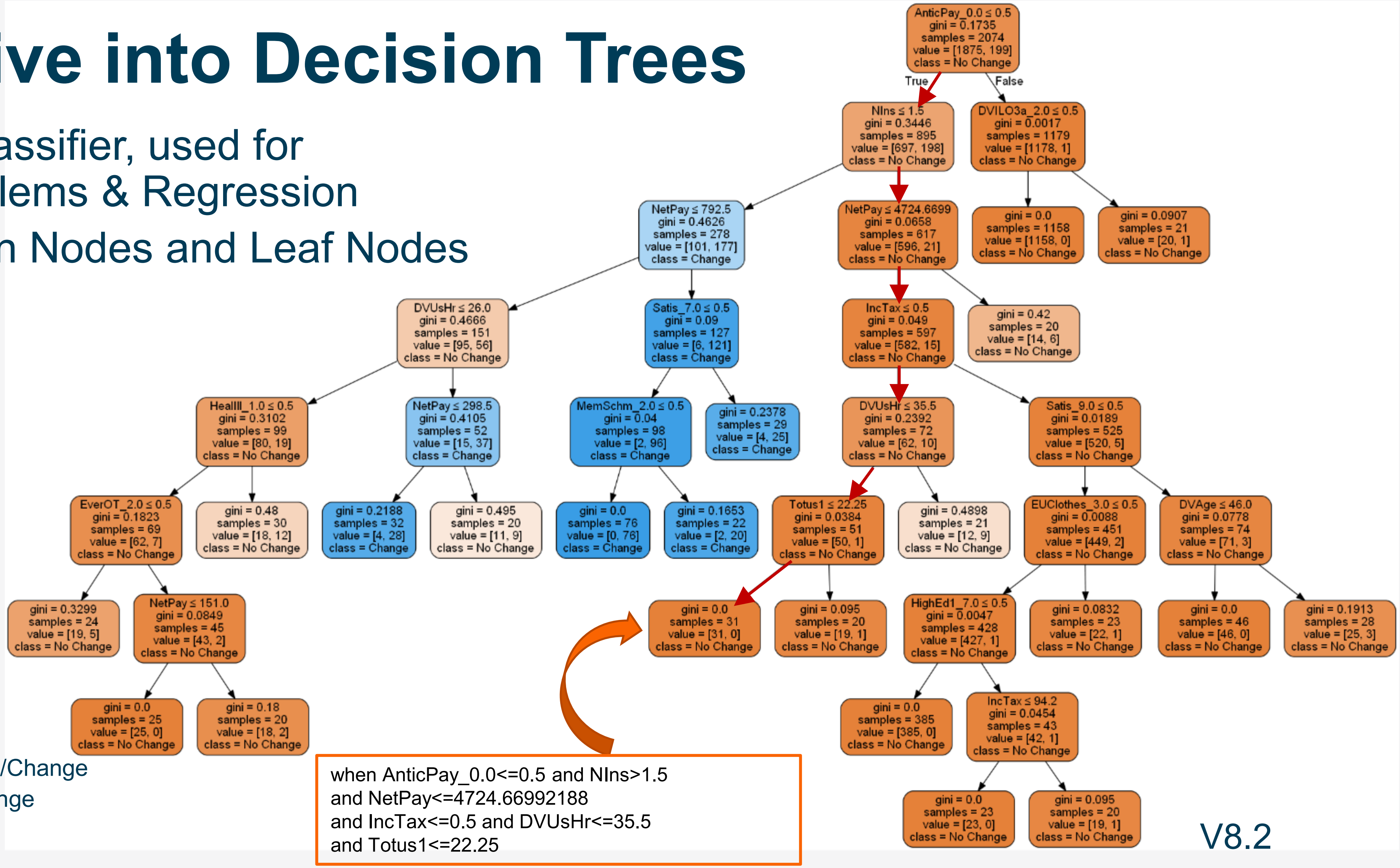
Entropy:

- Measure of Disorder

Regression

Residual squared error

- Editing of Income data
- Binary Classification – No_Change/Change
- Orange – No_Change   Blue - Change



when AnticPay_0.0<=0.5 and NIns>1.5
and NetPay<=4724.66992188
and IncTax<=0.5 and DVUsHr<=35.5
and Totus1<=22.25

V8.2

Decision Trees

```
# initialize the model
net_pay_Tree = tree.DecisionTreeClassifier(min_samples_leaf = 20)

# train the model
net_pay_Tree = net_pay_Tree.fit(df_pre_edit_train.drop(["Change"],axis=1),df_pre_edit_train['Change’])

# run the prediction on the test data and place the result into a new data frame df_net_pay_pred_test_proba
# this will hold the probability values of the prediction that a test case needs changing
df_net_pay_pred_test_proba = net_pay_Tree.predict_proba(df_pre_edit_test.drop(["Change"],axis=1))[:,1]

# create a binary data frame where a '1' indicates a probablity of > 0.5,  Threshold = 0.5
df_net_pay_pred_test_binary = df_net_pay_pred_test_proba > 0.5
```

Random Forest

- Single trees are weak classifiers:
  - Slight change of data → very different tree
  - Different tree → different prediction

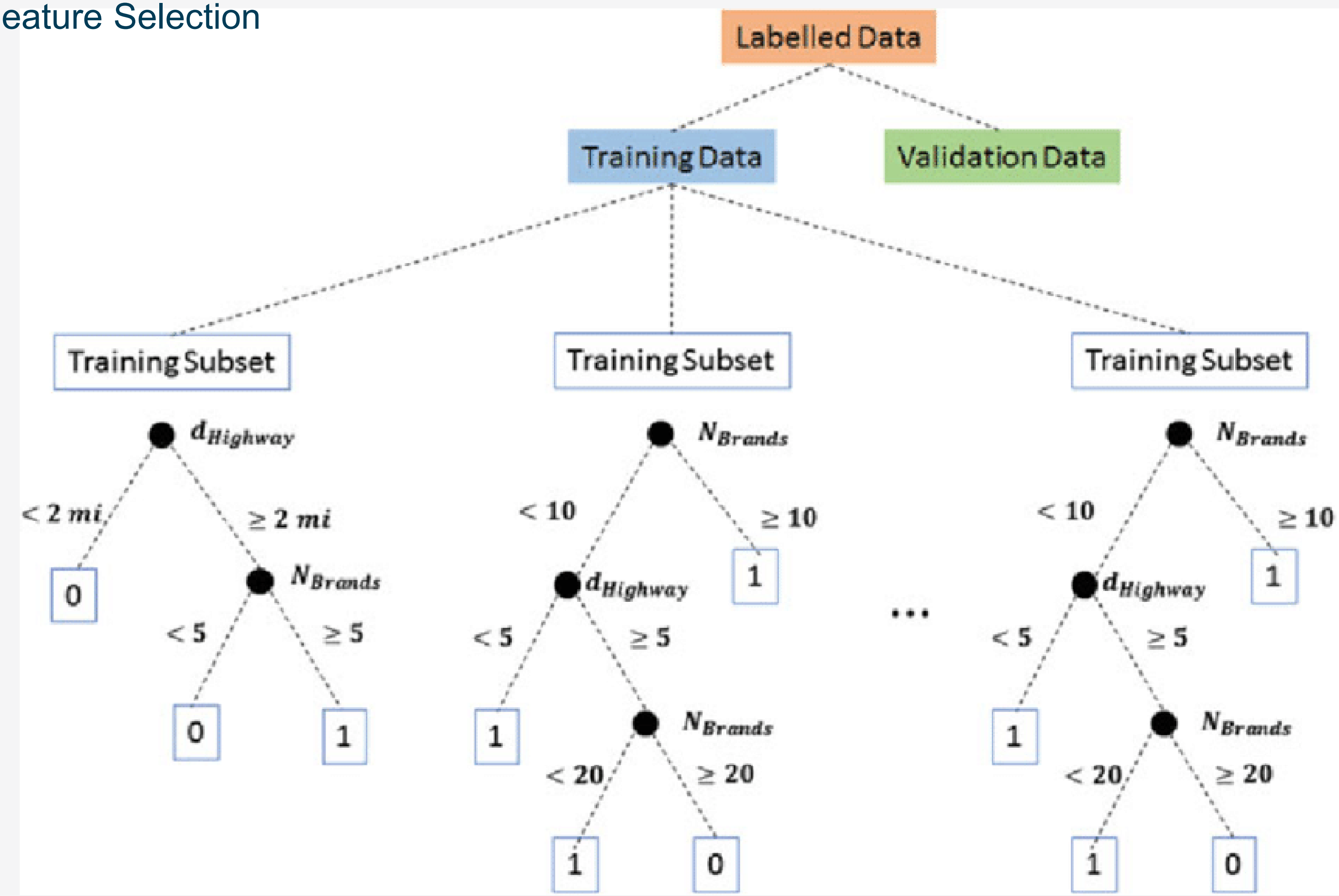
- Ensemble of many trees → Random Forest
  - Random selection of features for each tree → every feature can show its decision making power
  - Bagging (Bootstrap Aggregation) – Random Sample with Replacement of Training Data

    → each sample can have zero, one or more copies of the training records

    → each tree is trained with different data sets, but all have same size
  - Reduces dependency on training data → more accurate prediction
  - More accurate Feature Importance
  - Each tree ‘votes’ on the prediction → prediction score

Bootstrap Aggregation or Bagging – Random samples with replacement

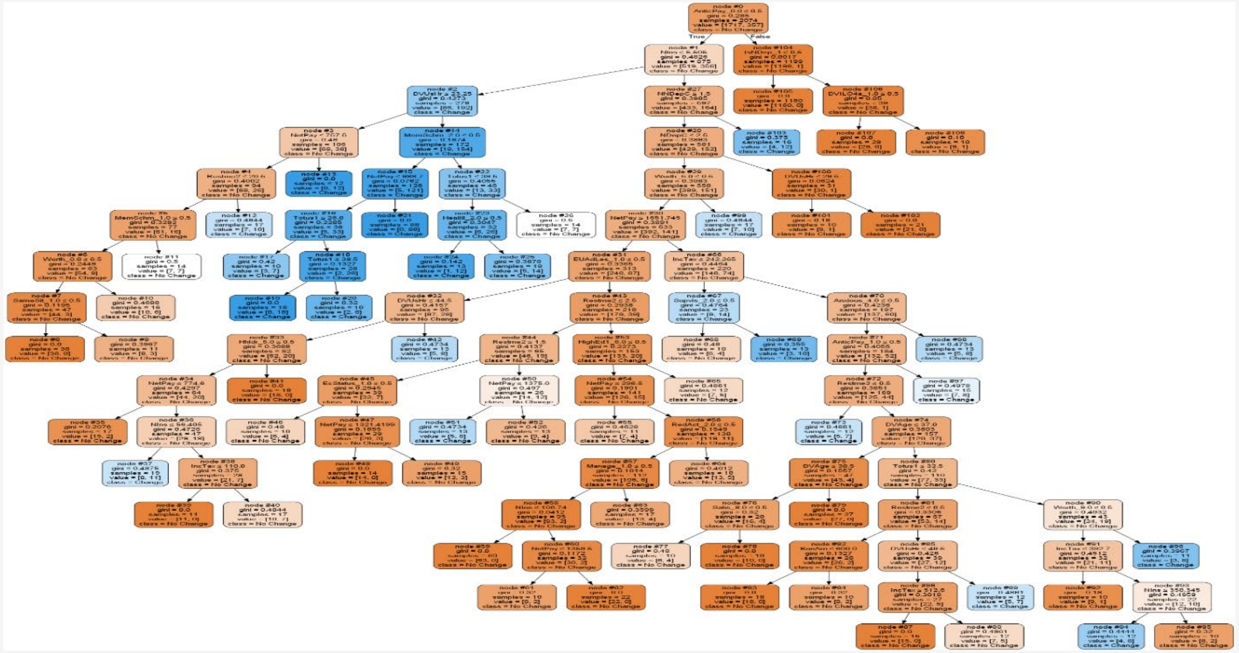
Random Feature Selection



Source: ResearchGate

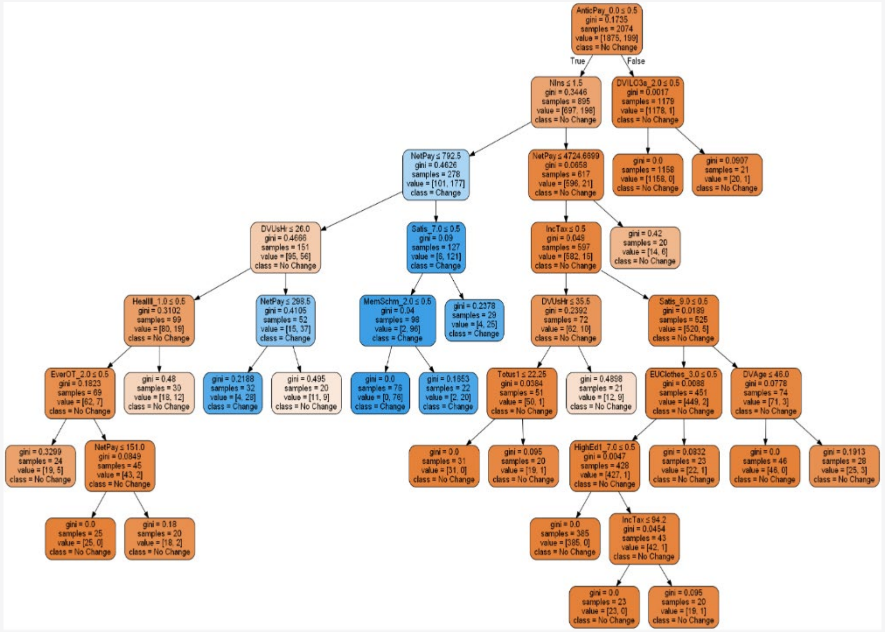
Managing Complexity of Tree based Models

Over-fitting



Boundary not well defined, complex rules
Very good Training data predictions

Under-fitting



Well defined Boundaries, simple rules
Not so good predictions

Hyperparameters in Random Forest

```
net_pay_Tree_orig = RandomForestClassifier
          (
          bootstrap = True,                       # bagging
          criterion = 'gini’,                     # gini measure to split nodes
          max_depth = 40,                         # depth of tree
          max_features = 'sqrt’,                  # number of features for each split
          max_leaf_nodes = 400,                   # grow trees with this number of leaf nodes
          min_samples_leaf = 5,                   # minimum of records in each leaf
          n_estimators = 1000,                    # number of trees
          n_jobs = -1                             # number of processors used, all if -1
          )
```

Hyperparameters tuning with GridSearch

```
parameter_grid = [
    {
     "bootstrap" : [True],
     "criterion" : ["gini"],
     "max_depth" : [40,45,50],
     "max_features" : ["sqrt"],
     "max_leaf_nodes" : [180,240,280],
     "min_samples_leaf" : [2,4,8,12,18] ,
     "n_estimators" : [165,175,200],
     "n_jobs" : [-1]
     }]


 net_pay_Tree = model_selection.GridSearchCV(ensemble.RandomForestClassifier(),
                              parameter_grid,
                              scoring = "f1"
                              cv = 5)

# 135 RandomForests will be trained
net_pay_Tree.best_params          # prints parameters for best RandomForest based on parameter_grid and scoring metric
```

Chapter 4 – Dimension Reduction

Please follow:

https://rb.gy/thaj99

Chapter 5 – Clustering

Please follow:

https://rb.gy/gnh6yi

Session Summary