Sports Data Analysis

Week 6

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Icebreaker

What is your favorite candy?

AND/OR

What is your comfort TV show?

Modeling

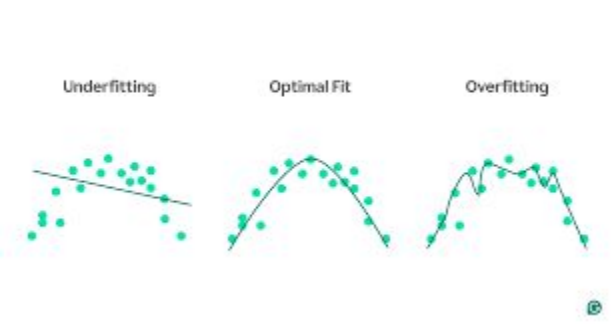
Modeling is (arguably) the most fun part of analytics

- Make **continuous** predictions (i.e. passing yards in a game, wins in a season) → **regression**
- Group data into **classes** (i.e. win/loss, draft round) → **classification**

Overfitting

Overfitting happens when the model starts fitting to the **random noise** in the training data instead of just the relationships

- Leads to a lack of **generalization** outside of the train data



Preprocessing

Before building your model, you often have to “preprocess” the data to get it in a way that’s useful

- For categorical data, try **one-hot encoding** if the categories have no order and **label encoding** if they do (turns them into numbers)
- **Scale/normalize** numerical features so big values don’t dominate little ones (passing yards doesn’t dominate interceptions thrown)

Preprocessing cntd.

- Scaling types include: **standardization** (z-scores), **min-max normalization** (puts the data between 0-1), and **robust scaling** (better if dealing with outliers)
- With a lot of columns, try **dimensionality reduction** through **Principal Component Analysis** (fewest number of variables to explain most of the variance) or **Feature Selection** (chooses a subset of columns that contribute most to model performance)

Useful Functions

- **Encoding:** get_dummies(df, columns=[ ]) for one-hot encoding, LabelEncoder() for label encoding
- **Scaling:** StandardScaler(), MinMaxScaler(), RobustScaler()
- **Dimensionality Reduction:** PCA(n_components =), SelectKBest(score_func = , k =)

Types of Models

Linear Regression

- The regression that you are most used to!
- Works by trying to minimize the sum of squared residuals (may **overfit** to do this)

Lasso/Ridge Regression

- Uses a **penalization** term to try and mitigate overfitting
- Lasso regression performs **variable selection** by setting some slopes to 0
- Ridge **keeps all variables** and just minimizes slopes

Types of Models

K-nearest neighbors

- Classifies data points by using the classification of the **“k” nearest data points** from training and predicting the majority class

Logistic Regression

- Builds a linear model to predict the **probability of something happening**
- It then chooses which class is most likely using that and can work for more than 2 classes

Some Useful Functions

- train_test_split(X, y, test_size) → as the name suggests, splits your data into a training subset and a testing subset (helpful to **avoid overfitting**)
- predict_proba(X) → gives you the **probabilities** associated with your classification with new data and a trained model
- LinearRegression(), LogisticRegression(), Ridge(), Lasso(), KNeighborsClassifier()

Questions?

Goals for This Week

We're going to begin the model building process!

1. If you haven't yet, make a **correlation matrix** and **correlation heatmap** (look at last week's example code!)
2. **Preprocess** your data (encode, standardize, maybe reduce dimensionality) for columns that **correlate to your chosen response variable** (look at this week's example code!)
3. If you have time, start making a model (can use the starter code or keep going on your current file)

Example Code

https://colab.research.google.com/drive/1nA9RCZsAa6-7LprrEnW1dvnvhbq5QegY?usp=sharing

Starter Code

https://github.com/MichiganDataScienceTeam/F25-SportsDataAnalysis/blob/main/Starter%20Code/modeling.ipynb