



Introduction to Predictive Analytics

The Analytics Question

For predictive analytics, there are two types of questions

1. **Quantitative Value:** what is our best prediction of the value of Y, for given values of X1, X2, X3, etc.?

Example: What is the predicted salary of an MS Analytics student 5 years after graduation, for a given GPA, years of experience, and functional domain?

2. **Classification:** what is our best prediction of how a new observation will be classified, given that we know X1, X2, X3, etc. ?

Example: Is a bank customer likely to default on a loan (i.e., classification is either default or no default), given the age of the loan, salary, number of cumulative days late, and amount of loans as a percentage of income?

Predictive Modeling

Parametric Model:

$f(X)$ is restricted by parameters (e.g., OLS \rightarrow model is linear, data is normally distributed)

Non-Parametric Model:

$f(X)$ is not restricted by parameters (e.g., KNN)



Goal: find the best predictive model based on various criteria !!

- Most **interpretable** (& **inference**) \rightarrow results explain relationships well
- Model **assumptions** are met \rightarrow may not be able to use some models
- High **accuracy** \rightarrow best of all feasible models
- Low **bias** \rightarrow prediction bias is minimized
- Low **computational cost** \rightarrow some methods are computationally costly

Analytics Modeling Options

| | Modeling Method | | |
|--------------------|---|---|---|
| | Structured | Visual, Text, Unstructured, etc. | |
| Descriptive | Cluster analysis, correlation, market basket analysis, sample statistics, ANOVA | Bubble charts, network diagrams, natural language processing, clustering dendograms, etc. | |
| Predictive | Association | Decision Tree | Charts |
| Quantitative Value | Regression | Regression Trees | Regression plots, scatter plots, Tableau diagrams, trend charts, etc. |
| Classification | Logistic Regression; Other Categorical Regression Models | Classification Trees | Tree maps, interactive diagrams, |
| Prescriptive | Operations research, decision modeling, optimization, linear programming | | Simulations, etc. |



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