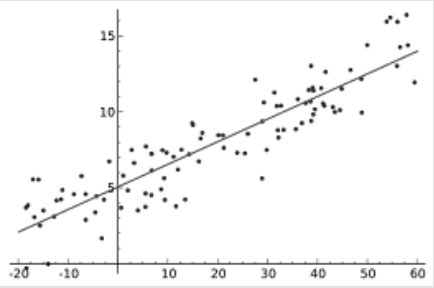
Three Common Types of Problem

Regression To find the relationship between a dependent variable and many independent variables

Classification To classify an observation to one of the several known catogories

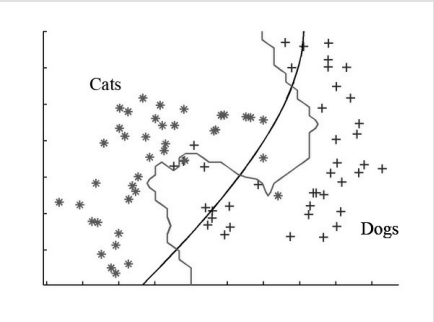
Clustering To group a set of objects into several unknown clusters

Regression



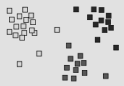
Model evaluation methods:
R^2, Adjusted R^2, MAE *(mean absolute error)*, MSE *(mean square error)*, RMSE *(root mean square error)*, AIC *(Akaike information criterion)*, BIC *(Bayesian information criterion)*, Residual analysis, Goodness-of-fit test, Cross validation

Classification



Model evaluation methods
Accuracy, Confusion matrix, Sensitivity and specificity, ROC *(receiver operating characteristic)*, AUC *(area under the curve)*, Cross validation

Clustering



Model evaluation methods
Models can be externally evaluated using data that are not used for clustering but with known class labels

General steps to build a model

1. Collecting the data.
2. Preparing the data and fixing issues such as missing values and outliers.
3. Use exploratory analysis to help study the content of your data and select a proper algorithm that suits your need.
4. Training a model using the algorithm you just selected. Start with a simple model that only uses the most important variables/features.
5. Check model performance using the evaluation methods.
6. If the model is not satisfactory, choose another algorithm or introduce different variables into the exsiting model.

Popular tools of implementation

R ML libraries including *stats*, *glmnet*, *caret*

Python popular packages for ML including *scikit-learn*, *statsmodels*

Alteryx Designer 'drag-n-drop' and requires minimum coding

Microsoft Azure Machine Learning Studio 'drag-n-drop' and requires minimum coding

Linear Regression

Learning style	Supervised
Problem	Regression
Use case	Revenue prediction

Widely used for predicting numeric values (or quantities). It trains and predicts fast, but can be prone to overfitting so proper feature selection is often needed.

Logistic regression

Learning style	Supervised
Problem	Classification
Use case	Customer churn prediction

A generalized linear model with dependent variable being binary (0-1). Mostly used to predict whether an event is going to occur based on the dependent variables.

Decision Tree

Learning style	Supervised
Problem	Classification/Regression
Use case	Targeted advertising

It requires little data preparation and can handle both numeric and categorical data. Easy to interpret and visualize but susceptible to overfitting.

Random Forest

Learning style	Supervised
Problem	Classification/Regression
Use case	Credit card fraud detection

An ensemble method that combines many decision trees together. It has all pros that a basic decision tree has, can handle many features and usually has high accuracy.

K-means

Learning style	Unsupervised
Problem	Clustering
Use case	Customer segementation

This method groups objects into k clusters. The goal is to have the objects in one cluster more similar to each other than to any object in other clusters. When k is not pre-determined, many methods can be used to find a good value of k, such as the elbow method and silhouette method.

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Naïve Bayes

Learning style	Supervised
Problem	Classification
Use case	Email spam filtering

A conditional probability model that assumes all features are conditionally independent on each other. Trains and predicts fast but the precision is low for small datasets and can suffer from 'zero--frequency' problem.

K-nearest Neighbors (KNN)

Learning style	Supervised
Problem	Classification
Use case	Bank credit risk analysis

A lazy learning algorithm that doesn't require much in training, but can be slow in prediction if you have a large data set.

Support Vector Machine (SVM)

Learning style	Supervised
Problem	Classification/Regression
Use case	Text classification

It uses some kernel function to map data points to a higher dimensional space and find a hyperplane to divide these points in that space. Ideal for very large data set with high dimensions, or if you know the decision boundary is not linear.

References

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