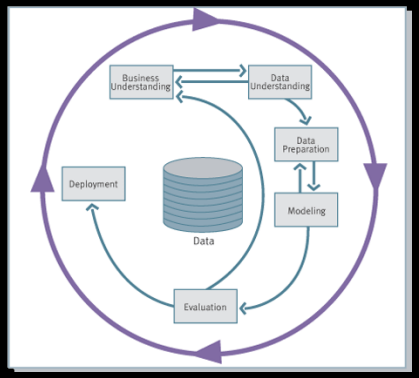
# Image Classification

Based on feature extraction and logistic regression

Zheng Xie

# Problem Description

- Classification of three kinds of image:
  - Photograph
  - Diagram
  - Clip


# Previous Study

- Feature extraction in different color space:
  - RGB / HSV / YUV / CIELAB
  - Color Histogram / Texture / …
- Algorithms:
  - Gaussian Classifiers
  - Multilayer Perceptrons
  - SVMs
  - ……

# Method Selection & Implement

- Logistic Regression
- Artificial Neural Network
- Support Vector Machine
- Decision Tree
- K-Nearest Neighbors
- K-Means

- Octave

# Method Selection & Implement

- Logistic Regression
- Artificial Neural Network (complex)
- Support Vector Machine (*[1])
- Decision Tree (rigid decision boundary)
- K-Nearest Neighbors (compute-intensive)
- K-Means (unsupervised)

- Octave



[1] http://www.quora.com/Support-Vector-Machines/What-is-the-difference-between-Linear-SVMs-and-Logistic-Regression

# Logistic Regression

- Simple to implement.
- Binary classifier?
- Powerful enough?
- Overfitting?

# Logistic Regression

- Simple to implement.
- Binary classifier? One vs All
- Powerful enough? Polynomial transform
- Overfitting? Regularization

# Dataset Collecting & Labeling

| | Clip | Diagram | Photograph | Total |
|---|---|---|---|---|
| Training | 37 | 31 | 41 | 108 |
| Test | 10 | 11 | 10 | 31 |
| Total | 47 | 42 | 51 | 139 |

# Features

- Histogram of Hue[2]
- Histogram of Saturation
- Variance of Saturation
- Mean of Value
- Variance of Value Histogram

[2] 冀翠萍，基于内容的图像分类研究

# Features

- Histogram of Hue[2]
- Histogram of Saturation
- Variance of Saturation
- Mean of Value
- Variance of Value Histogram

Training: 84.7%
Test: 70.1%



[2] 冀翠萍，基于内容的图像分类研究

# Features

- Histogram of Hue[2]
- Histogram of Saturation
- Variance of Saturation
- Mean of Value
- Variance of Value Histogram

Let’s have a look.

Training: 84.7%
Test: 70.1%



[2] 冀翠萍，基于内容的图像分类研究

# Further Optimizing

- Introducing quadratic polynomial features
- Feature Scaling & Mean Normalization
- Choosing Regularization Parameter – $\lambda$
  - K Fold Cross Validation
  - $\lambda = 0$ is best – maybe underfitting, not overfitting
- Testing…

# Conclusions

- Accuracy on training set: 98.16%
- Accuracy on test set: 93.55%

- To improve performance:
  - Add different features
  - Higher order polynomial transform
  - Other algorithms (e.g. artificial neural network)

# Demonstration

# Thanks for Listening