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Text Categorization
- Discriminative Methods

Hui Fang
Department of Electrical and Computer Engineering
University of Delaware

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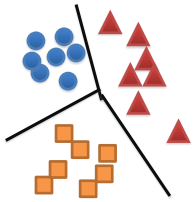
Discriminative Classifiers

- Rocchio classification
- KNN (K nearest neighbors)
- Support Vector Machines (SVM)



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Discriminative Method (1): Rocchio Classification

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Rocchio classification

- **Main ideas**
  - Representing documents as vectors
  - Assuming we have a distance measure between documents
  - Using centroids to define the boundaries
  - Assigning new documents to the category with the closest centroid

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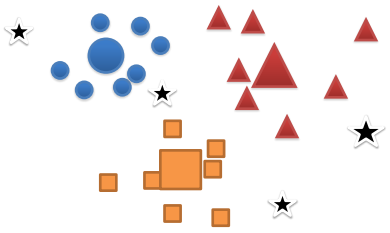
An Example of Rocchio classification



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How to compute Centroids?

$$centroid(c) = \frac{\sum_{d \in D_c} v(d)}{|D_c|}$$

where D_c is a set of all documents with label c and $v(d)$ is the vector space representation of d.

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Summary of Rocchio Classification Method

- It represents each class using its centroid.
- Assigning the label based on the distance to the centroids.
- It can not guarantee that classifications are consistent with the given training data
- Only used for text categorization, but quite effective

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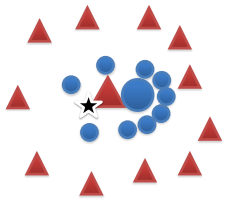
Limitaiton of Rocchio Classifier



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Discriminative Method (2): KNN

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K-Nearest Neighbor Classifier

- It does not learn any model in advance.
- Given a new document, find k training examples (i.e., neighbors) that are most similar to the new document.
- Assign the category that is most common in these neighbor documents

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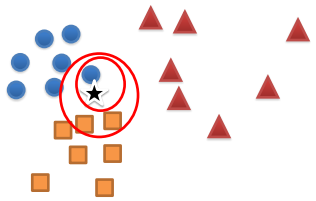
Example of K-NN Classifier



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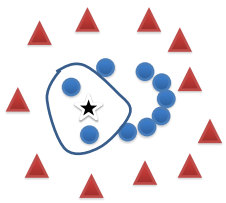
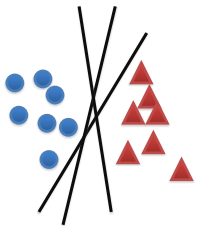
Revisiting the example



K-Nearest Neighbor Classifier

- Advantages
  - No Training needed
  - Intuitive
  - Empirically effective
  - Voting strategy can be improved by weighting the neighbors.
- Disadvantages
  - High time complexity
  - Performance is sensitive to the number of neighbors.

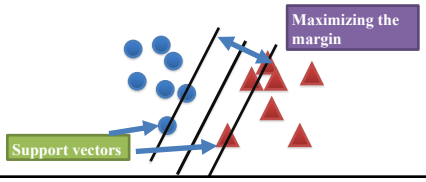
Discriminative Method (3): SVM



Find a,b,c, such that
- *ax+by>c, blue*
- *ax-by < c, red*

Support Vector Machine

- It finds an optimized solution by maximizing the distance between the hyperplane and the "difficult points" close to decision boundary



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