Image Classification using Support Vector Machine and Artificial Neural Network

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2012/12/20
Outline

• Introduction
• Artificial Neural Network (NN)
• Support Vector Machine (SVM)
• The stages of image classification
• ANN_SVM model
• Experiment and Analysis
• Conclusion
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Introduction

• There are various approaches for solving this problem such as
  - k nearest neighbor (KNN)
  - Adaptive boost (Adaboosted)
  - Artificial Neural Network (ANN)
  - Support Vector Machine (SVM)

• The aim of this paper is bring together two areas in which are Artificial Neural Network (ANN) and Support Vector Machine (SVM) applying for image classification
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Artificial Neural Network (ANN)
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Support Vector Machine (SVM)

- SVM builds the optimal separating hyper planes based on a kernel function (K)
- All images, of which feature vector lies on one side of the hyper plane, are belong to class -1 and the others are belong to class +1
Choose the one with large margin!
Kernel function

one-against-rest

one-against-one

SVM

k

k

k

k

k
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The stages of image classification

- **Original Image**
- **Pre-Processing**
  - Crop / Normalize
  - Histogram Equalization
  - Noise Filter and Image Segmentation
- **Feature Extraction**
  - feature extraction: PCA, ICA...
- **Classifying**
  - classification system: K-NN, NN, SVM ...
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Image classification using ANN_SVM model
ANN classification

\[ \text{CL}_i = (x, y, z), \quad 0 \leq x, y, z \leq 1 \]
SVM for identifying weight

- There are $k$ classification results.
- Weighted mean value is better than mean value.
- SVM uses to identify the suitable weights.

$$\frac{1}{k} \sum_{i=1}^{k} W_i \times CL_{SS_i}$$

$$\sum_{i=1}^{k} W_i = 1$$
SVM for identifying weight

\[ W = [a, b] \]

\[ 10X + 2Y + C = 0 \]

\[ aX + bY + c = 0 \]
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Experiment and Analysis

• Roman numerals classification
• Fast Artificial Neural Network (FANN) library applies for developing the Artificial Neural Network
• Accord.NET applies for developing Support Vector Machine (SVM)
• The precision ratio = \frac{\text{correct classifying samples}}{\text{sum of testing samples}}
Roman numeral to shape matrix
ANN classification
Roman numerals classification

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<th>Testing Times</th>
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<th>Precision</th>
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<td>10</td>
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<td>10</td>
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<tr>
<td>10</td>
<td>X</td>
<td>100%</td>
</tr>
</tbody>
</table>

- Precision rate is 86%
GUI of application demo
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Conclusion

• ANN_SVM is the integrating model of two kinds of soft computing technique in image classification

• ANN_SVM is a two layers classifier
Conclusion

• Pros
  – ANN_SVM is easy to design and deploy for the specific classification problem
  – The precision is high

• Cons
  – The performance of processing time need to improve
  – The training time of ANN_SVM is also a problem in the large dataset
  – Redesign and rework all ANN_SVM model when the number of classes increases
Our Opinions

• It is a model to solve image classification beside traditional model for the specific classification problem

• Performance of processing time can improve by parallel computing