

Digit Recognition

with Support Vector Machines

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Overview

Outline

1. Introduction & Problem Statement
2. Support Vector Machines (SVM)
3. Sequential Minimal Optimization (SMO)
4. Multi-Class Classification
5. Results & Conclusions

Introduction & Problem Statement

Main Goal: train algorithm to recognize handwritten digits

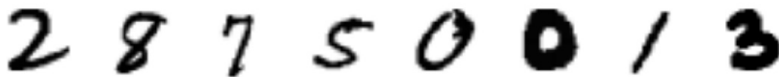


Figure: Visualization of eight of these images

Data:

- ▶ 42,000 grayscale

Introduction & Problem Statement

Support Vector Machines (SVM)

Support Vector Machines (SVM)

Sequential Minimal Optimization (SMO)

Multi-Class Classification

Standard Modell

- ▶ SVMs are binary classifiers but we needed to be able to differentiate among 10 classes
- ▶ there are different ways to tackle this problem, we decided to mainly focus on two different approaches:
 1. One-vs-All
 2. Error Correcting Output Codes

Multi-Class Classification

1. One-Vs-All

Multi-Class Classification

2. Error Correcting Output Codes Idea:

Class	f_0	f_1	f_2	f_3	f_4	f_5	f_6	f_7	f_8	f_9	f_{10}	f_{11}	f_{12}	f_{13}	
0	1	1	-1	-1	-1	-1	1	-1	1	-1	-1	1	1	-1	
1	-1	-1	1	1	1	1	-1	1	-1	1	1	-1	-1	1	
2	1	-1	-1	1	-1	-1	-1	1	1	1	1	-1	1	-1	
3	-1	-1	1	1	-1	1	1	1	-1	-1	-1	-1	1	-1	
4	1	1	1	-1	1	-1	1	1	-1	-1	1	1	-1	-1	
5	-1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	-1	-1	
6	1	-1	1	1	1	-1	-1	-1	-1	1	-1	1	-1	-1	
7	-1	-1	-1	1	1	1	1	-1	1	-1	1	1	-1	-1	
8	1	1	-1	1	-1	1	1	-1	-1	1	-1	-1	-1	1	
9	-1	1	1	1	-1	-1	-1	-1	1	-1	1	-1	-1	1	