Parametric vs. Non-Parametric: Gaussian Random Processes and Support Vector Machines for Digit Recognition

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Abstract:

Motivated by brief previous exposure to Gaussian Random Processes (GRP), we will explore the parametric hypothesis class of GRPs and their utility in select machine learning applications. Specifically, we will apply GRPs to handwritten digit recognition using datasets of digits collected by the United States Postal Service (USPS). Two USPS datasets will be considered, namely a binary dataset (where the task is to distinguish between the digit “3” and the digit “5”) and a 10-digit dataset (where the task is to classify the digits “0” through “9”).

As an extension to this work, we will implement a Support Vector Machine (SVM), a non-parametric model, and classify the same two datasets. We will compare the results as well as discuss the advantages and disadvantages of GRPs vs. SVMs.

Through this comparison, we hope to provide intuitive considerations and tradeoffs between the two models. Time permitting, we will apply the GRP and SVM models to other datasets in an effort to find situations where one model is better than the other and vice-versa.