Department of Mathematics and Statistics

Colloquium Series

Gaussian Process Models for Computer Vision

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Abstract: Supervised learning is the task of finding a function $f(x)$ that maps an input x to an output y using observed data. Gaussian process models approach supervised learning by assuming a probability distribution over a space of possible functions, using observed data to update the space of functions to consider using Bayes theorem, and taking the expected value over the space of functions to get an estimate for $f(x)$. While Gaussian process models are commonly used in time series and regression domains, they can extend to classification tasks using a response function and variational inference. This thesis investigates Gaussian process models for image classification tasks with an emphasis on kernels that are effective for the high dimensional nature of image data. Specifically, stationary and non-stationary kernels are compared with each other and their performance is analyzed on image recognition tasks. The models are evaluated on high-resolution aerial images, a handwritten digit dataset, and a dataset of X-ray images of patients exhibiting signs of pneumonia.

Keywords: Computer vision, image classification, supervised machine learning, Gaussian process models

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