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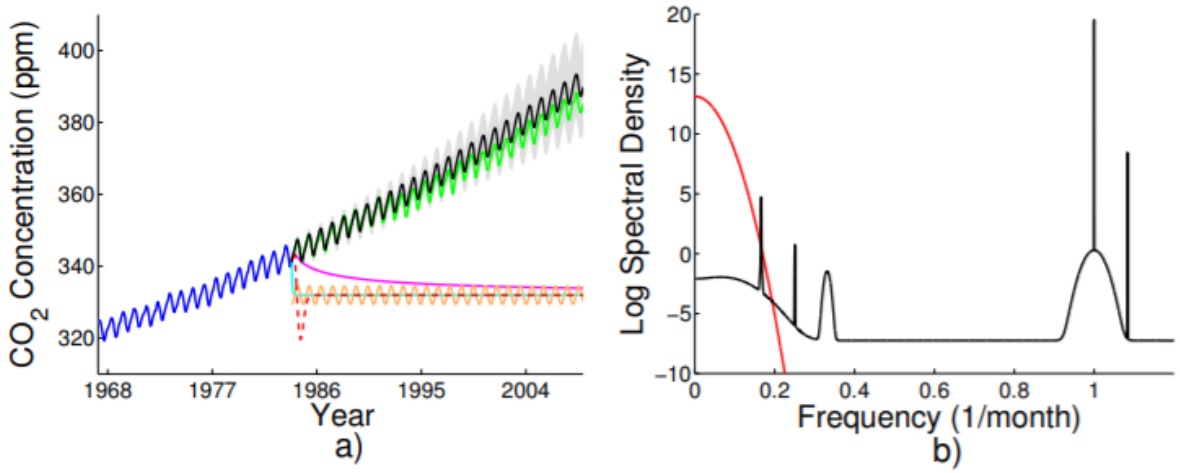
EE/CS599 – Fall 2019

Project 2 Week 1

Figure 1



Citation:

Wilson, Andrew, and Ryan Adams. "Gaussian process kernels for pattern discovery and extrapolation." *International Conference on Machine Learning*. 2013.

For the this figure it is taken from Gaussian process kernels for pattern discovery and Extrapolation looking at the Mauna Loa CO2 concentration. Taking the forecasting data that was kept since 1968 to 2004 as the training data. Then comparing the SM kernel against the test output, Matern, Squared Exponential, rational quadratic, and the periodic kernels. The second figure is the log spectral densities of the learned SM and squared exponential kernels for a comparison of the two. Overall this figure is to prove the ability of extrapolation for pattern discovery with the gaussian process.

Link for dataset: https://cims.nyu.edu/~andrewgw/pattern/

The dataset can easily be found online as it is public record. Andrew Wilson also posted his dataset that he uses. He does use a .mat file, so I will have to convert it to copy his figure correctly. I plan on running some code in MATLAB and then there is a conversion function I can use in MATLAB for converting the data to something I can use in python. For the labels, the x label is going to be the year and the y will be the co2 concentration.

For this figure the importance will be to study the spectral mixture kernel. There are four key hyperparameters: weight, variance, mean, and the noise variance. For this project my goal is to understand the how the SM kernel works and then moving over the program from MATLAB to python, as the author uses functions in MATLAB that probably cannot be found in python.

Pseudo code (so far):

-input dimensionality

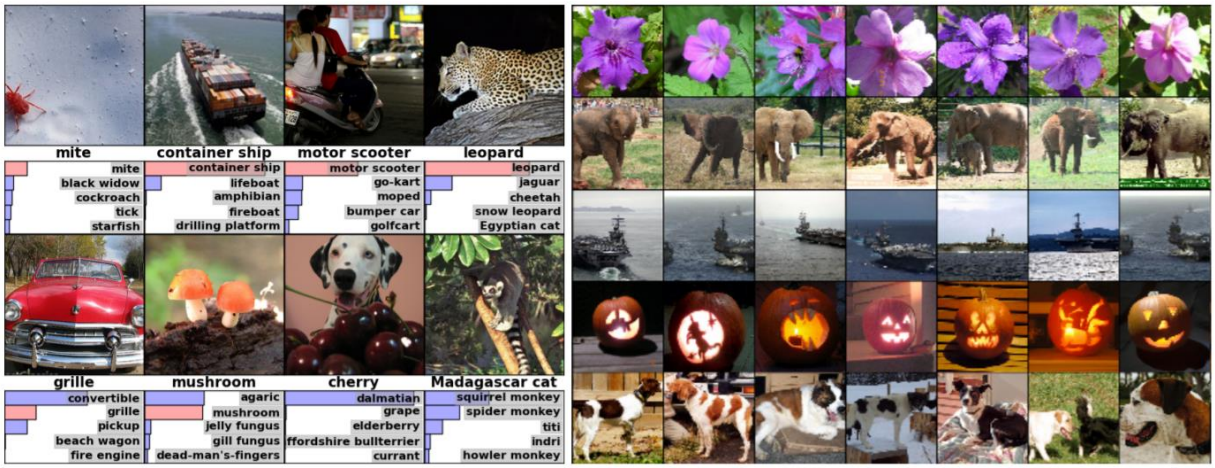
-number of covSM components

-try random initialization

-initialize SM helpers

-use spectral mixture to do regression

Figure 2



Citation:

Krizhevsky, Alex, Ilya Sutskever, and Geoffrey E. Hinton. "Imagenet classification with deep convolutional neural networks." *Advances in neural information processing systems*. 2012.

In this figure the authors use deep convolutional neural network to classify 1.2 million high resolution images in ImageNet. This program was built with the intention of going to the ImageNet LSVRC competitions. Which in turn makes is where I am able to grab the data (http://www.image-net.org/challenges/LSVRC/2010/#data). Though a problem that I would have to consider if I wish to duplicate this figure would be the size of the data and the processing power of the GPU's. As the paper mentions it took 2 GPU's to run. Even with that to analyze 1.2 million labeled training examples would take a considerable amount of time given this project only last 6 weeks. If I were to attempt this, I would look into the neural network in which they implemented, especially in how it works with the image recognition that they implemented as well.