

# Cs584 Project proposal – Generalized Classifier Neural Network (GCNN)

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Jacob Kisiel – A20281402  
Camila García – A20372381  
Department of Computer Science  
Illinois Institute of Technology  
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## Paper

One pass learning for generalized classifier neural network  
Ozyildirim, Buse Melis, and Mutlu Avci. "One Pass Learning for Generalized Classifier Neural Network." *Neural Networks* 73 (2016): 70-76. *ScienceDirect*. Web. 8 Mar. 2016. <<http://www.sciencedirect.com/science/article/pii/S0893608015002087>>.

## Problem

The Generalized Classifier Neural Network (GCNN), as well as several other algorithms, makes use of the Radial Basis Function (RBF). The efficiency of this algorithm is bottle necked by the optimization of a single parameter known as the smoothing parameter, or variance. An optimal, or closely fitted smoothing parameter is defined as being smaller than the average Euclidean distance between a pattern neuron and its neighbors; this has been found in the past by making an educated guess via the data, and then performing gradient descent to minimize error without overfitting data. Gradient descent for this problem is very time consuming. The proposed algorithm has been recorded to be significantly faster.

## Approach

The proposed solution is to use what is to be called One Pass Generalized Classifier Neural Networks (OGCNN). This calculates a smoothing parameter per class by means of standard deviation and mean value based functions (which function is used is determined by the standard deviation of the features, and thresholding to allow the method to deal with large ranges of values).

We would implement GCNN and the One pass modification and compare the two. If time allowed we would also find other methods of speeding up this optimization (a Logarithmic approach was mentioned in the paper), and apply those as well.

It would be implemented by hand in Python using Numpy, but mostly otherwise by hand. Any additional algorithms will likely be found implemented in other packages and used for comparison to our implementation.

## Data

The paper research used 14 datasets that can be found in the UCI repository. We plan on using at least 6 of those:

- Iris: <http://archive.ics.uci.edu/ml/datasets/Iris>
- Vehicle:  
<http://archive.ics.uci.edu/ml/datasets/Statlog+%28Vehicle+Silhouettes%29>
- Sonar:  
<http://archive.ics.uci.edu/ml/datasets/Connectionist+Bench+%28Sonar%2C+Mines+vs.+Rocks%29>
- Image Segmentation:  
<http://archive.ics.uci.edu/ml/datasets/Image+Segmentation>
- Breast Cancer Wisconsin:  
<http://archive.ics.uci.edu/ml/datasets/Breast+Cancer+Wisconsin+%28Original%29>
- Pen – digits: <http://archive.ics.uci.edu/ml/datasets/Pen-Based+Recognition+of+Handwritten+Digits>

These datasets have rather varied numbers of points, features, and classes. It seems like a good spread to test an implementation on. The other datasets are detailed in the paper, and are not difficult to find, though it might be advantageous to diverge from the ones selected by the researchers and test on new data. This would be done after a baseline of these 6 datasets has been conducted.