**1. Definition**

**Large-scale Identification of Multiple Digits**

**From Real-World Images with Deep Convolutional Networks**

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**1.1 Overview**

This project explores how deep convolutional neural networks (ConvNets) can be used to effectively identify a series of digits from real-world images that are obtained from “The Street View House Numbers (SVHN) Dataset” (Netzer, Wang and Coates). ConvNets have evolved dramatically every year since the inception of the ImageNet Challenge in 2010.

A proverbial ConvNet structure is the “LeNet-5” that has relatively few layers of convolutions, poolings, and full connections (LeCun, Bottou and Bengio). Subsequently, with the advent of the ImageNet Challenge, we are experiencing a gradual trend towards deeper ConvNets with more layers and higher accuracy such as AlexNet (Krizhevsky, Sutskever and Hinton), ZFNet (Zeiler and Fergus), VGGNet (Simonyan and Zisserman), GoogLeNet (Szegedy, Liu and Jia), and the ResNet (He, Zhang and Ren) being the latest state-of-the-art implementation of ConvNets.

To this point, we will be begin with a basic ConvNet and progress to deeper ConvNets to determine the optimal model for identifying multiple digits from real-world images.

Our programming language of choice is Python and we will be using the Python API from TensorFlow to build our deep convnets.

**1.2 Problem Statement**

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1.3 Metrics

2. Analysis

2.1 Data Exploration

2.2 Exploratory Visualization

2.3 Algorithms and Techniques

2.4 Benchmark

3. Methodology

3.1 Data Pre-processing

3.2 Implementation

3.3 Refinement

4. Results

4.1 Model Evaluation and Validation

4.2 Justification

5.0 Conclusion

5.1 Free-Form Visualization

5.2 Reflection

5.3 Improvement: ResNet