

# Read Digits from Natural Images using Convolutional Neural Network

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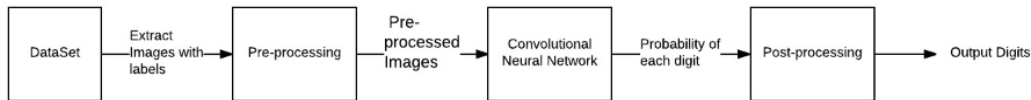
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- This is an optical character recognition (OCR) problem
- Digit recognition is used in various applications such as postal mail sorting, bank check processing, form data entry, etc
- Digit recognition is an important component of modern-day map making [1]

- The task is to read digits from natural images
- We use the Street View House Numbers dataset [2], which consists of real-world images taken from house numbers
- We use convolutional neural networks(CNN) for fast processing, accuracy and speed

- Wide variability of visual appearance of text: fonts, colors, and orientations [1]
- Different environmental factors: lightning, shadows, and occlusions [1]
- Image acquisition factors: motion, blurring, and resolution [1]

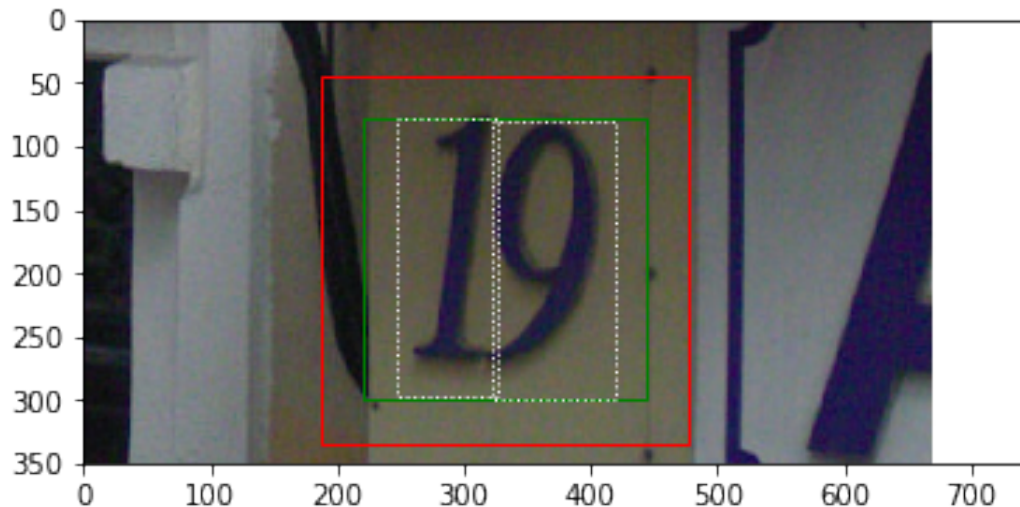
- Load and Interpret DataSet(done)
- Pre-processing(started)
- Convolutional Neural Network(started reading)
- Post-processing(yet to start)



**Figure:** Block Diagram of System



**Figure:** Street View House Numbers Data set [2]



**Figure:** Reading labeled data and generating bounding box



**(a)** Cropped image



**(b)** Gray scale

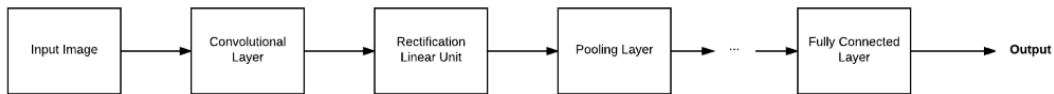


**(c)** Gaussian blur



# Convolutional Neural Network(CNN)


- State-of-the-art shows CNN performs better as compare to other approaches[3]
- Extracts features from the images and classify them
- Three type of layers
  - Convolutional: Extract low-level and high-level features
  - Pooling: Reduce amount of parameters and computations
  - Fully Connected: Neurons are fully connected




**Figure:** Basic Architecture of CNN

- Combine digits and show complete output


- Consider maximum digits in image are 5
- Test the images of digits from live camera under different conditions
- Use validation set from dataset to compute accuracy of model

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*CoRR*, abs/1312.6:1–13, 2013.

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<http://ufldl.stanford.edu/housenumbers>.

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 Pierre Sermanet, Soumith Chintala, and Yann LeCun.  
**Convolutional neural networks applied to house numbers digit classification.**

In *ICPR*, pages 3288–3291. IEEE Computer Society, 2012.

 Yuval Netzer, Tao Wang, Adam Coates, Alessandro Bissacco, Bo Wu, and Andrew Y Ng.

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In *NIPS workshop on deep learning and unsupervised feature learning*, volume 2011, page 5, 2011.