

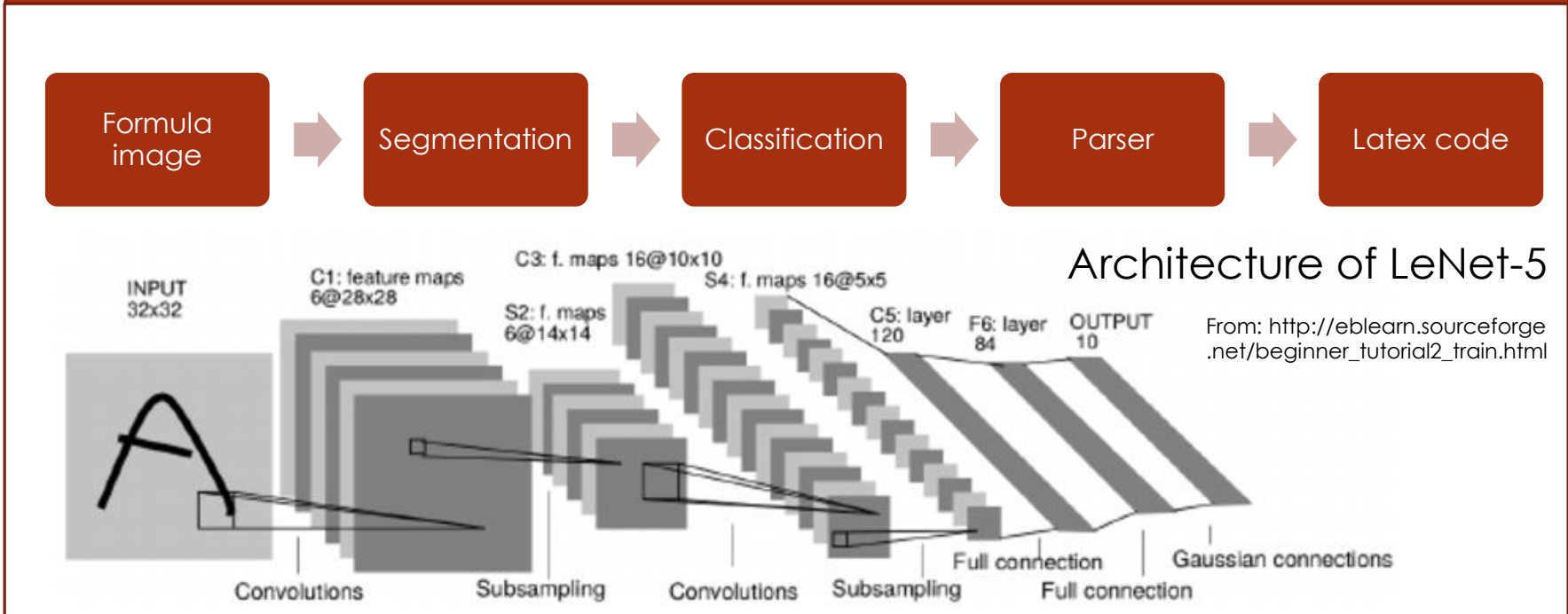
# Offline Mathematical Expression Recognizer

Shawn Peng: yisupeng@iu.edu  
Yang Zhang: zhang505@Indiana.edu

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Prof. David Crandall



## System Architecture



## Data Set

7 Digits

K English

Ψ Greek

∫ Math Symbols

MNIST

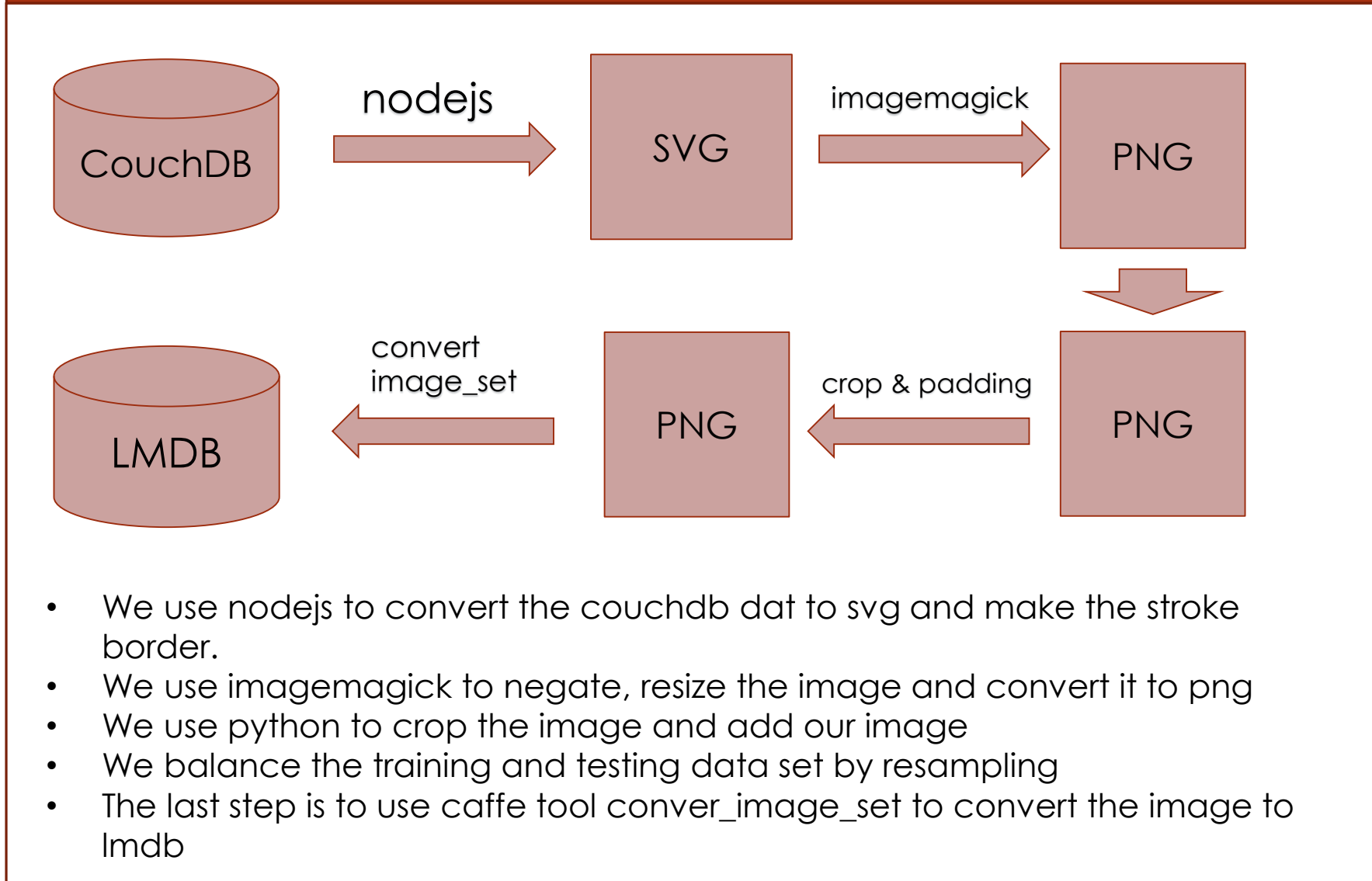
Chars74K, Write-Math

Detexify

Write-Math

Since we use different data sources, and they use different image formats, we need to preprocess those data. Some of them is preprocessed, like mnist and Chars74K dataset, but Chars74k, Detexify and write-math dataset use white background.

## Preprocessing



## Conclusion & Discussion

First, we found it is very useful to have the character to be properly bold before we send it to the convolutional neural network. For svg image this can be done very easily, for images one thing we can use is the dilation.

Second, in the training of our convolutional neural network (we use LeNet), we find it is very useful to perform the trim operation on images.

On the other hand, the problem is that we do not have enough data to train neural network. We have enough digit number and geek letter data, but for English letter we only get 50 samples. We believes that is the problem that we only get 81.5% accuracy.

We have not begin to do grammar parse because of the poor performance of classifications.

We thank Prof. David Crandall for really helpful comments and discussions. We also thank Dr. Daniel Kirsch and Martin Thoma to provide us the permission to the handwrite data.

## Segmentation

$$e^{xi} = \cos x + i \sin x$$

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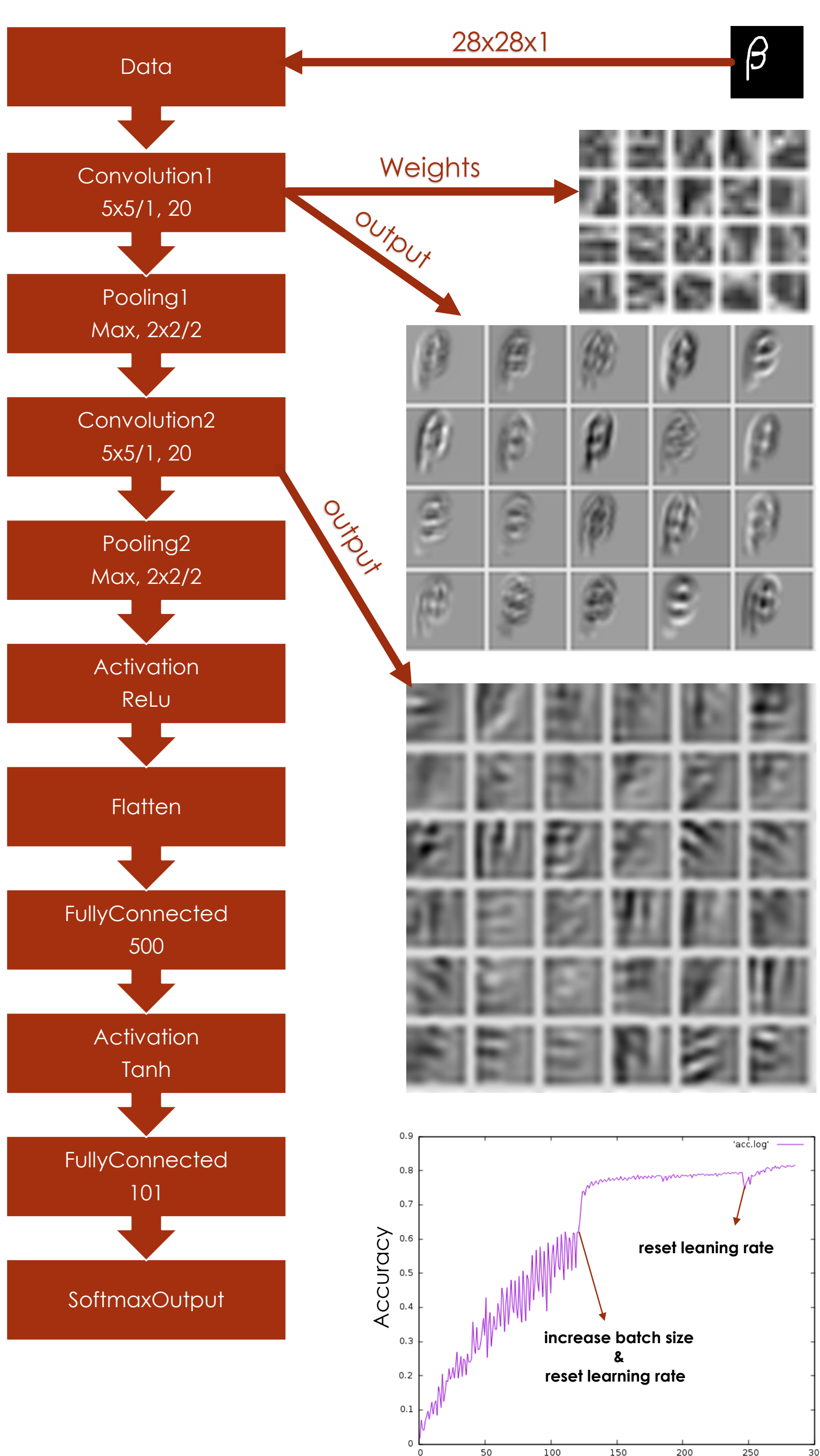
10	15	10	15	10	10
15	10	10	10	15	10
100	100	100	100	100	100
100	100	100	60	60	100
100	100	100	60	50	100
100	100	50	60	50	60

From: [http://elearn.sourceforge.net/beginner\\_tutorial2\\_train.html](http://elearn.sourceforge.net/beginner_tutorial2_train.html)

From: Proj. Crandall's B657 course ppt

We use the spanning tree algorithm, which treat the image as a graph, and assign edge to every two adjacent pixels, according to their difference in color. After we construct the graph, we find the minimum spanning tree for this graph, and cut some edges with weights over a threshold to get a forest.

## Convolutional Neural Network



Tech we used

