Pattern Recognition with Deep Boltzman Machines

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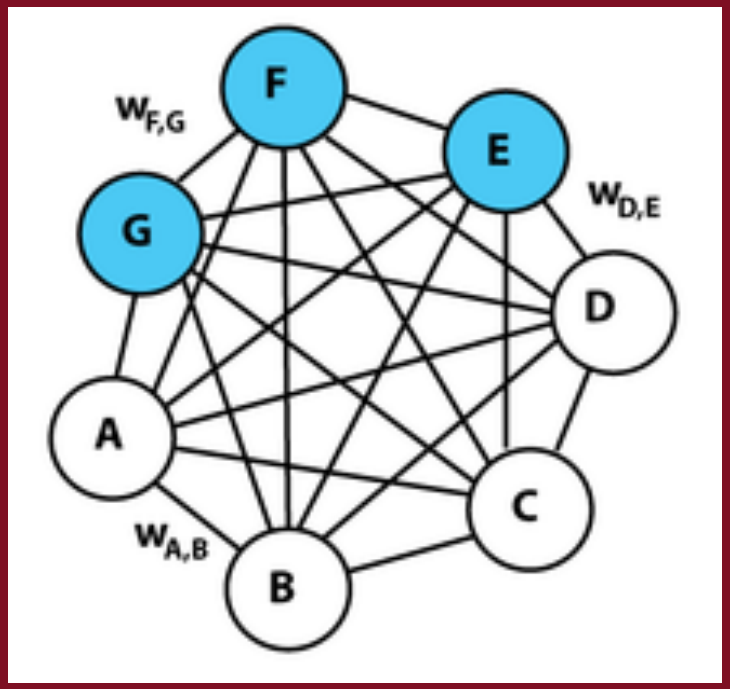
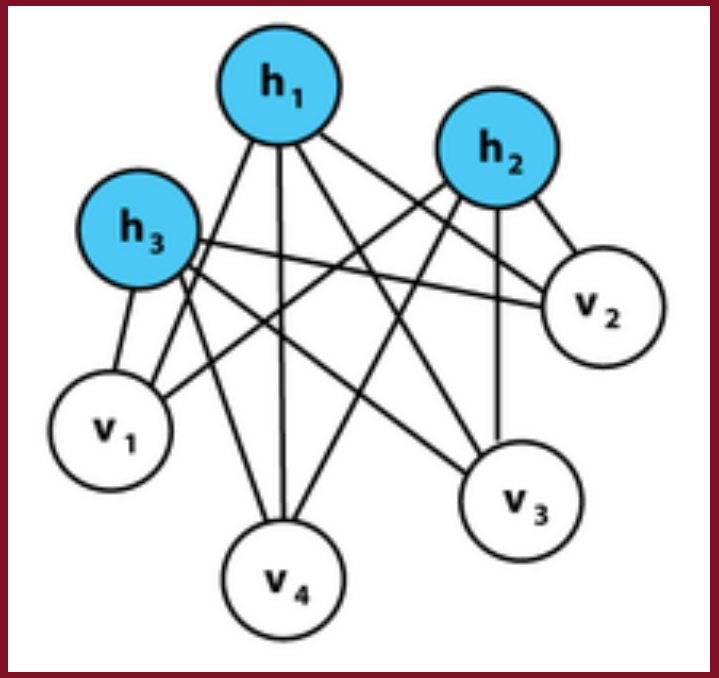
Summary of Problem

- Pattern Recognition

Background on Deep Boltzmann Machines



Boltzmann Machine



Restricted Boltzmann Machine

Background on Deep Boltzmann Machines

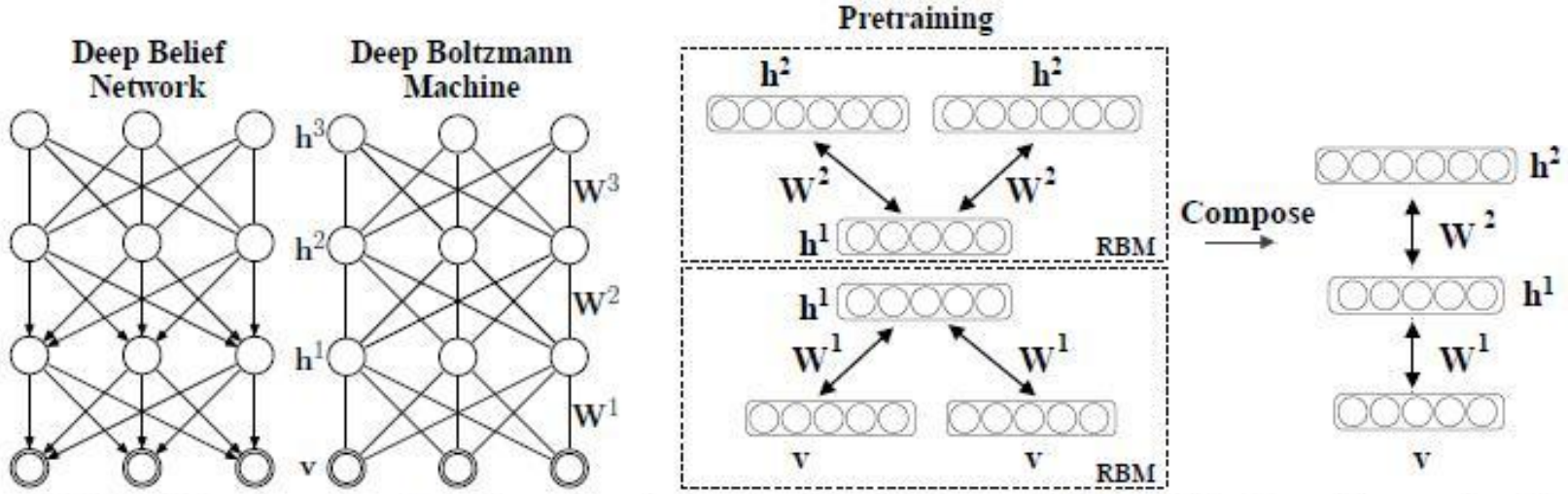


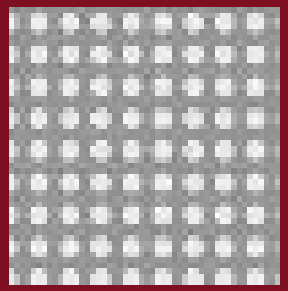
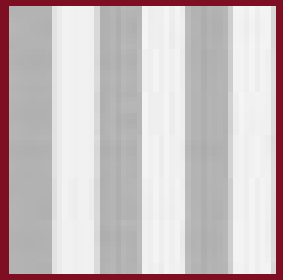
Figure 2: **Left**: A three-layer Deep Belief Network and a three-layer Deep Boltzmann Machine. **Right**: Pretraining consists of learning a stack of modified RBM's, that are then composed to create a deep Boltzmann machine.

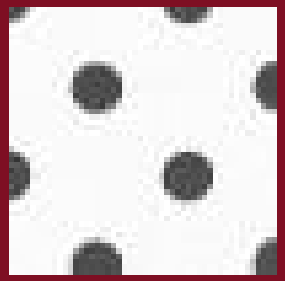
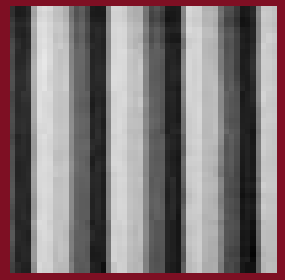
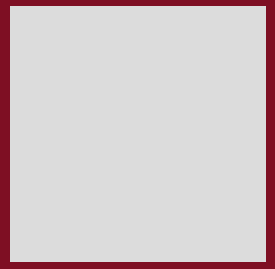
Our Approach

- Training and testing sets
- Image processing
- Training with RBMs to create images
- Building a DBM to find classification errors

Our Approach-Image Processing

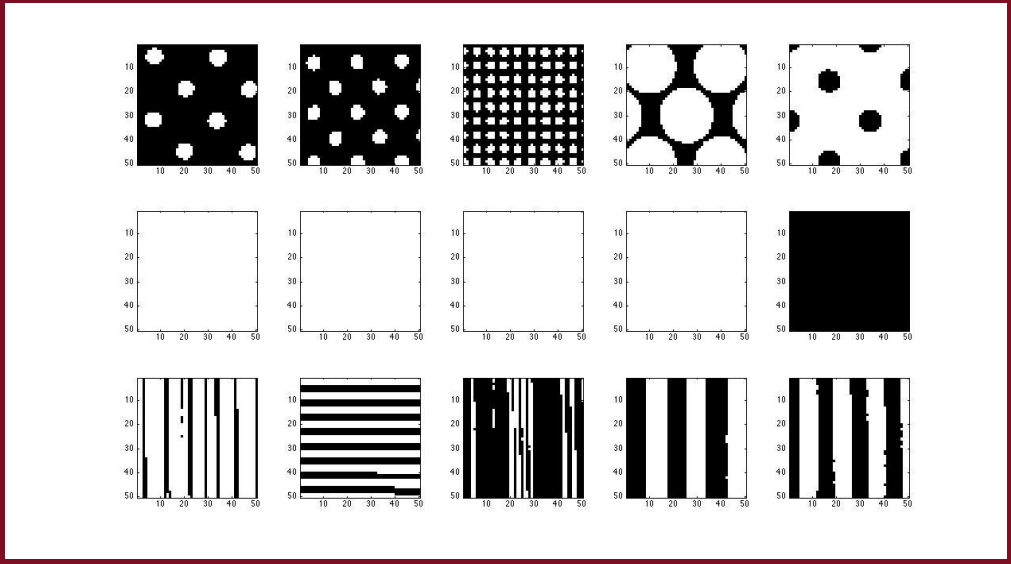
- Manual conversions for uniformity
  - 50x50 pixels
  - Grayscale

Our Approach-Image Processing

- Matlab processing
  - Ultimately convert to binary in .mat file
  - Save classification labels for each image



Our Approach-Neural Network

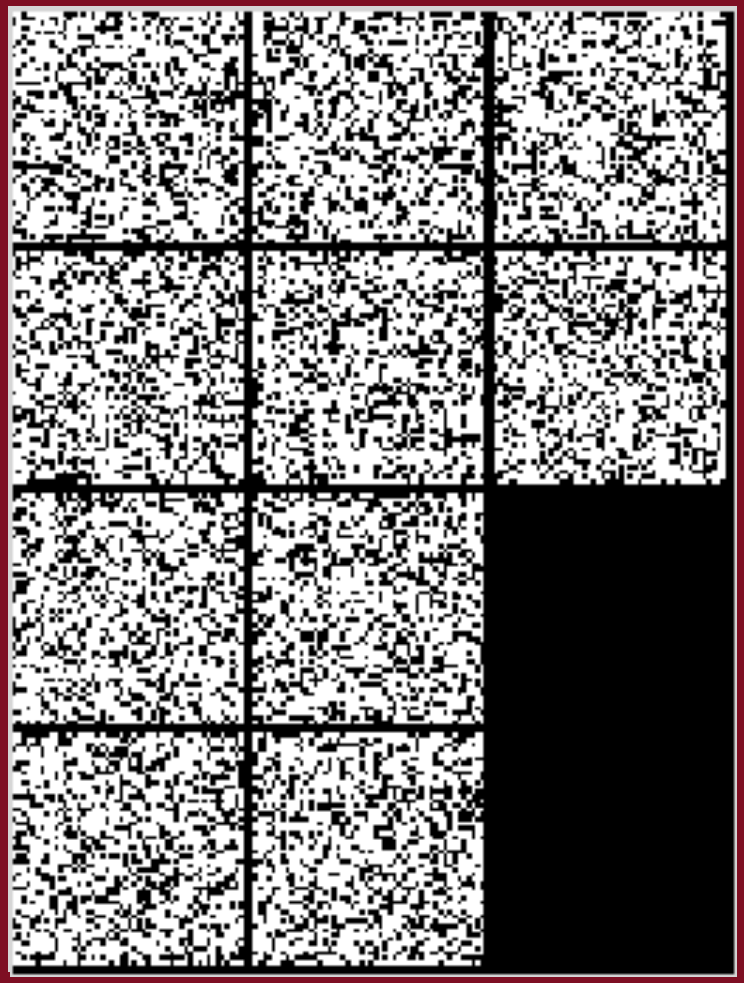
- Pre-train 3 layers of RBMs
  - 500 neurons in the first two layers, 2000 neurons in the last layer

Our Approach-Neural Network

- Making a Deep Boltzmann Machine
  - Use the defining values from the RBMs to classify the training and testing data

Our Results - Training 3 layers of RBMs

- Not the worst…
  - Layer 1:
  - Layer 2:
  - …and Layer 3:



Our Results - Testing

- Not so good
- 63% misclassification rate (for 3 layers)

Future Work

- Improve code compatibility

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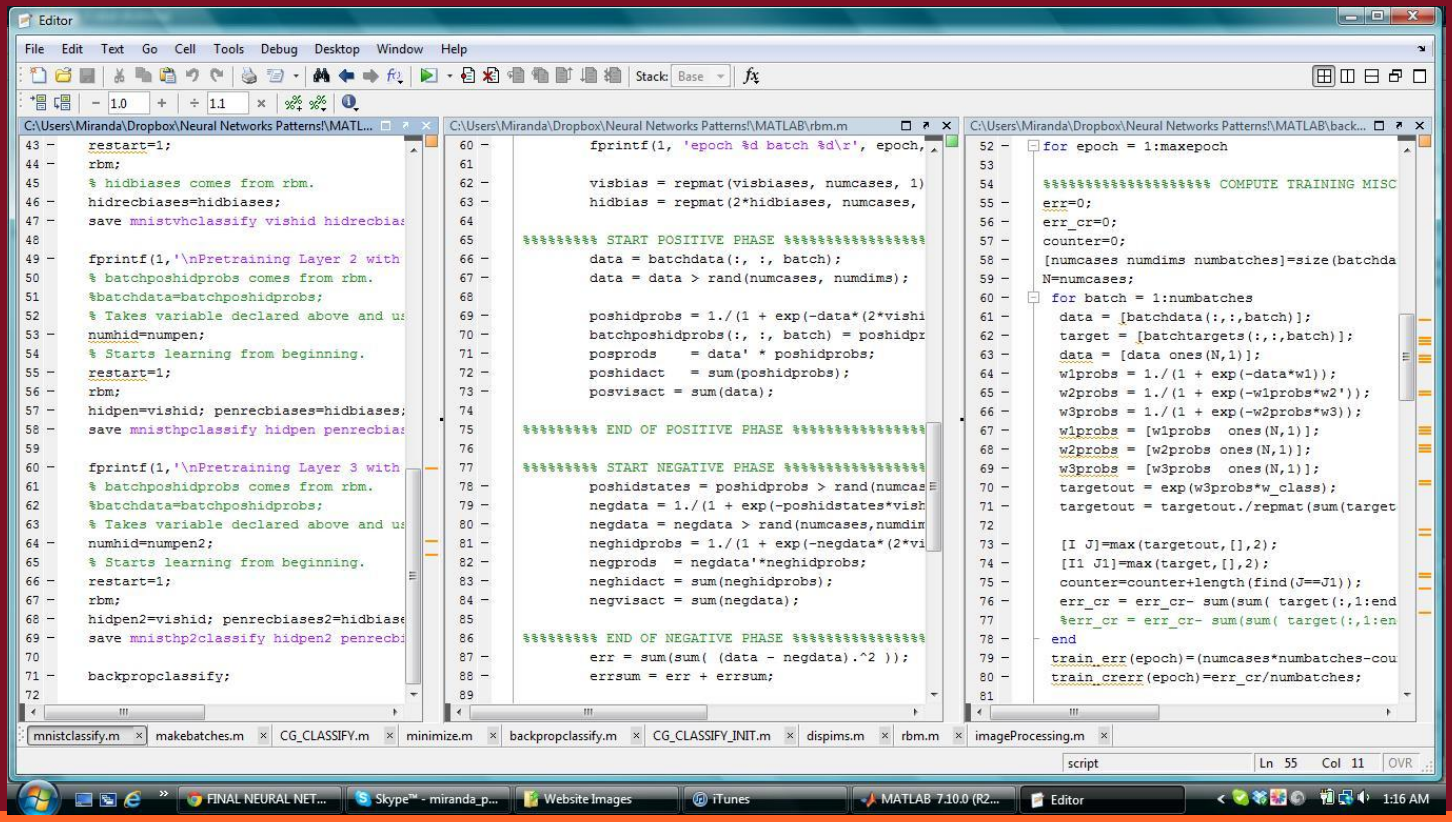
Elegance & Simplicity

Scenario

Quinn was asked to write a function to check an array of floating point numbers to make sure none are zero. The function will be used to check a column vector of coefficients in a scientific computation, which would fail if any of the coefficients were zero.

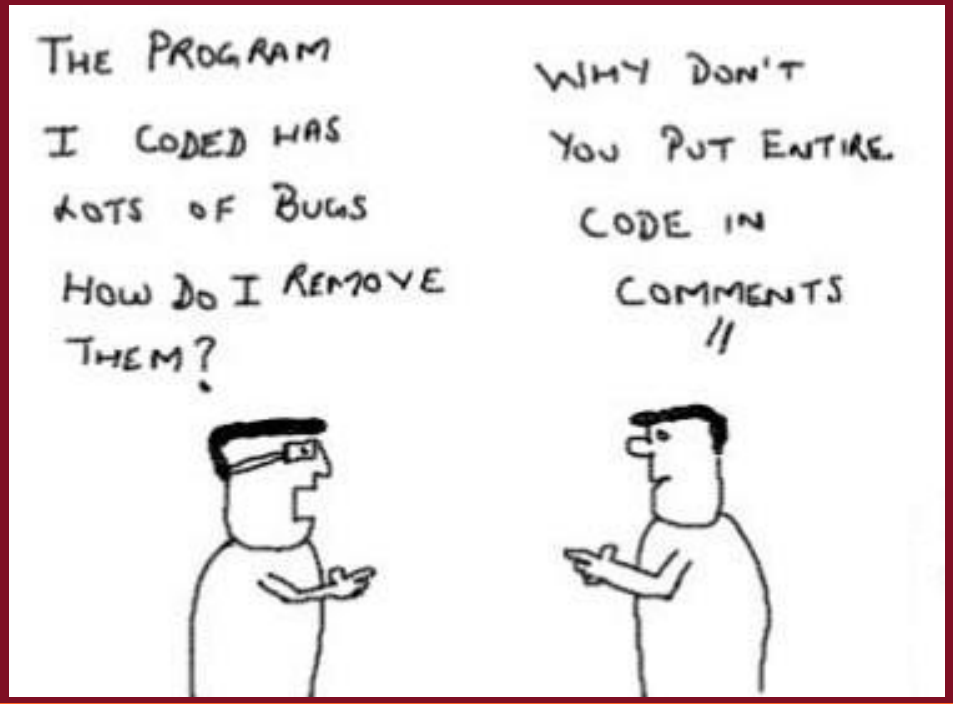
Future Work

- Comment the Code!



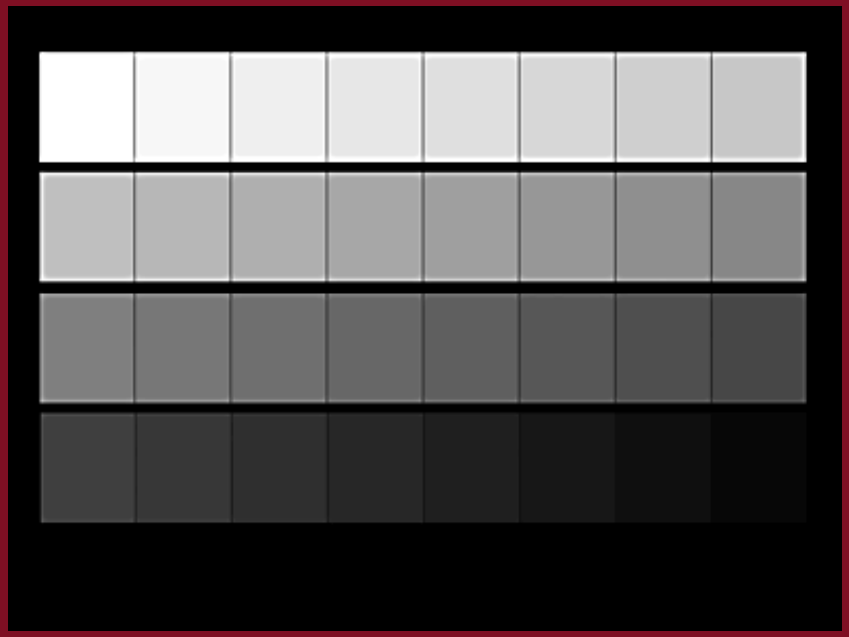
Future Work

- Improve performance
- Use more patterns!



Future Work

- Sanity check - no interference = good results?



References

http://deeplearning.net/software_links/

http://www.cs.utoronto.ca/~rsalakhu/papers/dbm.pdf

http://www.cs.toronto.edu/~hinton/MatlabForSciencePaper.html