Neural Networks - HW5

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March 30, 2017

1 Algorithms

1.1 Neural Networks - feed forward and back propagation

Following functions are written for the Neural Networks

sigmoid(x) : Performs sigmoid function on variable x

dersig(x) : Outputs the value after x is substituted for the derivative of sigmoid function

hiddenlayernode(val, act) : A class to create a hidden layer node. Stores node value, activation value and out going branch weight

inputlayernode(val) : A class to create input node. Takes input node values and stores outgoing branch weight.

opnode() : A Class to create output node and store node value and activation value.

feedforwardbackpropogation$(inputnodes, hiddennodes, label)$: Performs feed forward and back propagation and develops the neural network.

prediction$(inputnodes, hiddennodes, label)$: Function to calculate the accuracy of the constructed neural network on the test data.

main() : Main function to read the input data and set initial parameters to construct the neural network

2 Software Familiarization

2.1 TensorFlow and Keras

Neural Network for image recognition is implemented using Keras using TensorFlow backend in file named **neural.py** Input is read converted into vector and normalized. Output is encoded. The neural network model is built using three layers - one input, one hidden and one output. Hidden layer contains 100 neurons. Sigmoid function is activation function. Loss correction is done using categorical_crossentropy. Model is fit to the data. 1000 epochs and one image sent to network at a time. Error rate of 2.41% is achieved.

2.2 Improvements for Implemented Algorithm

- All the images provided for this assignment are of the same dimension. If images of different dimensions are provided, then, the existing code needs to be improved upon.
- The hidden layer currently has 100 neurons. The code can be improved to include flexibility.

3 Applications

Applications of Neural Networks can be widely classified into the following sections.

3.1 Character Recognition

The idea of using feed forward networks to recognize handwritten characters is rather straightforward. As in most supervised training, the bitmap pattern of the handwritten character is treated as an input, with the correct letter or digit as the desired output. Normally such programs require the user to train the network by providing the program with their handwritten patterns.

3.2 Image Compression

[STA]The input is used as its own output for training purposes. The input (for the applet) is produced from the training image by extracting small chunks of the image chosen at a uniformly random location in the image. This data is presented over and over, and the weights adjusted, until the network reproduces the image relatively faithfully.[STA]

3.3 Finance

[STA] Neural Networks have been extensively used for the following purposes. Currency prediction Futures prediction Bond ratings Business failure prediction Debt risk assessment Credit approval Bank theft Bank failure[STA]

3.4 Medicine

[STA]The data may include heart rate, blood pressure, breathing rate, etc. to different models. The models may include variations for age, sex, and level of physical activity. Each individual's physiological data is compared to previous physiological data and/or data of the various generic models. The deviations from the norm are compared to the known causes of deviations for each medical condition. The neural network can learn by studying the different conditions and models, merging them to form a complete conceptual picture, and then diagnose a patient's condition based upon the models.[STA]

4 Responsibility division between Teammates

We, Karthik and Praneet have brain-stormed and implemented the assignment with equal contribution for every line of code.

5 References

[STA]https://cs.stanford.edu/people/eroberts/courses/soco/projects/neural-networks/index.html
http://machinelearningmastery.com/object-recognition-convolutional-neural-networks-keras-deep-lea