A Novel Method for Handwritten Digit Recognition System

PROPOSED SOLUTION

PROBLEM STATEMENT

The problem statement is to classify handwritten digits. The goal is to take an image of a handwritten digit and determine what that digit is. The digits range from zero (0) through nine (9).

IDEA/SOLUTION DESCRIPTION:

we propose a novel method to compute the learning rate for training deep neural networks with stochastic gradient descent.

Handwritten digit recognition has recently been of very interest among the researchers because of the evolution of various Machine Learning, Deep Learning and Computer Vision algorithms. In this report, we compare the results of some of the most widely used Machine Learning Algorithms like CNN- convolution neural networks and with Deep Learning algorithm like multilayer CNN using Keras and TensorFlow. MNIST is a dataset which is widely used for handwritten digit recognition. The dataset consists of 60,000 training images and 10,000 test images. The artificial neural networks can all most mimic the human brain and are a key ingredient in image processing field. For example, Convolution Neural networks with back propagation for image processing.

NOVELTY:

- Character recognition plays an important role in the modern world. It can solve more complex problems and makes humans' job easier.
- An example is handwritten character recognition. This is a system widely used in the world to recognize zip code or postal code for mail sorting.
- There are different techniques that can be used to recognize handwritten characters. Two techniques researched in this paper are Pattern Recognition and Artificial Neural Network (ANN) and Convolution Neural Network(CNN) using MNIST dataset.
- Handwritten digit recognition using MNIST dataset is a major project made with the help of Neural Network. It basically detects the scanned images of handwritten digits.
- We have taken this a step further where our handwritten digit recognition system not only detects scanned images of handwritten digits but also allows writing digits on the screen with the help of an integrated GUI for recognition.

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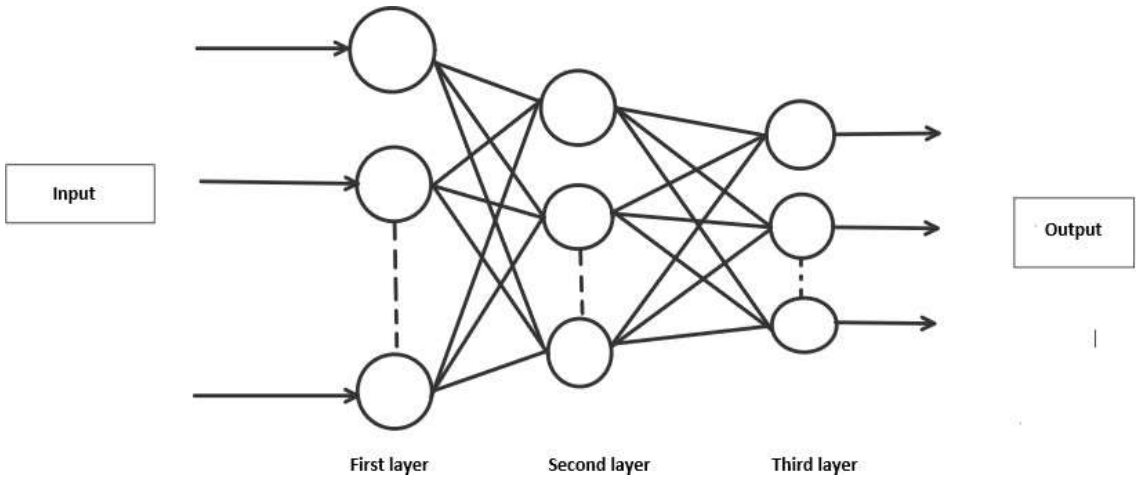
NEURAL NETWORK

A neural network is a model inspired by how the brain works. It consists of multiple layers having many activations, this activation resembles neurons of our brain. A neural network tries to learn a set of parameters in a set of data which could help to recognize the underlying relationships. Neural networks can adapt to changing input; so, the network generates the best possible result without needing to redesign the output criteria.

APPROACH

We will approach this project by using a three-layered Neural Network.

- **The input layer**: It distributes the features of our examples to the next layer for calculation of activations of the next layer.
- **The hidden layer**: They are made of hidden units called activations providing nonlinear ties for the network. Several hidden layers can vary according to our requirements.
- **The output layer**: The nodes here are called output units. It provides us with the final prediction of the Neural Network based on which final predictions can be made.



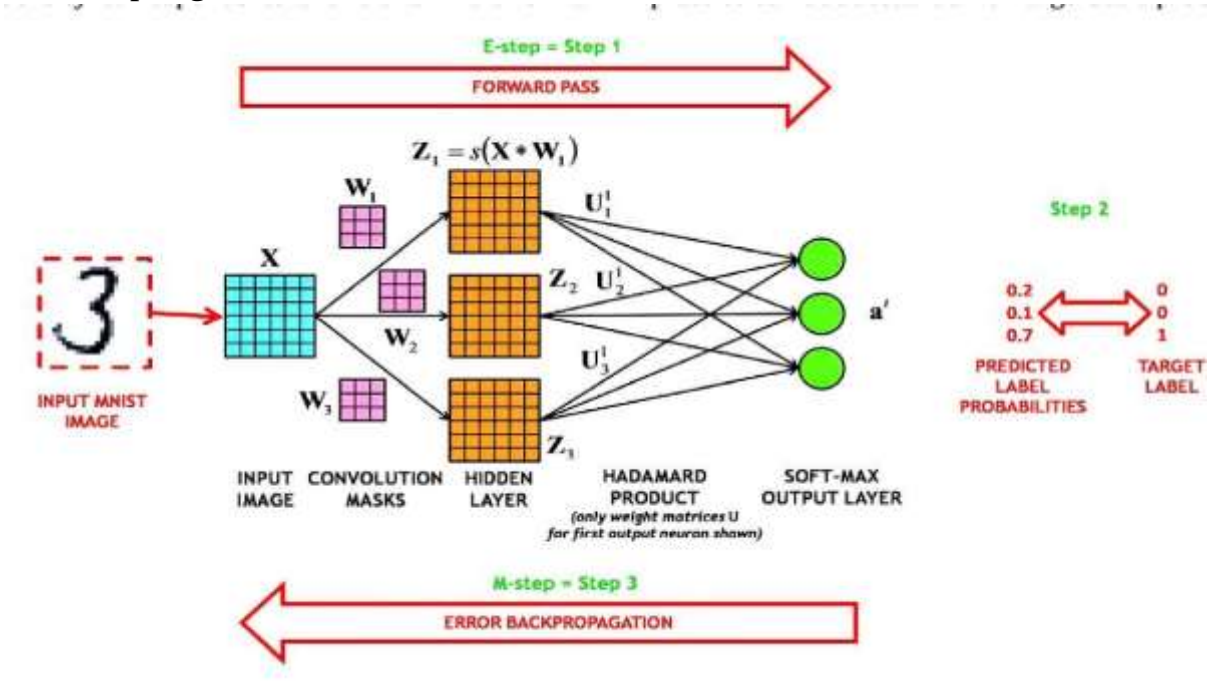
ARCHITECTURE FOR NEURAL NETWORK

ALGORITHM

Forward Propagation:

Architecture:

Below shown is a small workflow of how CNN module will extract the features and classify the image based on it. The architecture shows the input layer, hidden layers and output layer of the network. There are many layers involved in the feature extraction phase of the network which involves convolution and subsampling.



BUSINESS MODEL

- MNIST ("Modified National Institute of Standards and Technology") is considered an unofficial computer vision "hello-world" dataset. This is a collection of thousands of handwritten pictures used to train classification modelsusing Machine Learning techniques.
- As a part of this problem statement, we will train a multi-layer perceptron using TensorFlow to recognize the handwritten digits.
- The applications where these handwritten digits recognition can be used are **Banking sector** where it can be used to maintain the security pin numbers, it can be also used for blind peoples by using sound output.

SOCIAL IMPACT

Machine learning and deep learning plays an important role in computer technology and artificial intelligence. With the use of deep learning and machine learning, human effort can be reduced in recognizing, learning, predictions and many more areas