



High Impact Skills Development Program **AI & Data Science**

Neural Network Module Project-I

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Project Title: Convolutional Neural Network Classification on SVHN Dataset.

1. Project Overview

This project demonstrates the implementation of a neural network to classify street view house numbers (SVHN) using the SVHN dataset. The goal is to predict the correct digit in house numbers based on image input using a deep learning model.

2. Objective

The primary objective of this project is to:

- Build and train a neural network using the SVHN dataset.
- Evaluate the model's performance on test data.
- Visualize the classification results.

3. Technologies Used

- **Programming Language:** Python
- **Libraries:**
 - TensorFlow/Keras: for building and training the neural network model.

- NumPy: for data manipulation.
- Matplotlib: for plotting predictions.
- Scikit-learn: for data preprocessing and performance evaluation.

4. Dataset

The **SVHN (Street View House Numbers)** dataset is used for this project. It contains images of house numbers collected from Google Street View, with each image centered around a single digit. The dataset consists of over 600,000 labeled digit images.

- **Training Set:** 73,257 samples.
- **Testing Set:** 26,032 samples.
- Each image is 32x32 pixels and labeled with a digit from 0 to 9.

The images are preprocessed and normalized before being fed into the neural network.

5. Implementation

The neural network is built with the following key steps:

1. **Data Loading and Preprocessing:**
 - The SVHN dataset is loaded and normalized to ensure better training performance.
2. **Neural Network Architecture:**
 - Input Layer: 32x32 image input.
 - Hidden Layers: Several convolutional layers with ReLU activation functions, followed by max-pooling layers.
 - Output Layer: A softmax layer with 10 outputs (one for each digit class).
3. **Model Training:**
 - The model is trained using the training set with a categorical cross-entropy loss function and an Adam optimizer.
4. **Evaluation:**
 - The model is evaluated on the test set, and performance metrics such as accuracy and loss are calculated.

6. Results

The model was evaluated using accuracy on the test set, achieving a reasonable level of performance given the complexity of the SVHN dataset. Below is a visualization of some test samples, comparing true labels with predicted labels.

Sample Visualization

The following plot showcases a few test samples along with their true labels and the predicted labels from the model:

7. Challenges Faced

- **Data preprocessing:** The images required normalization and reshaping for optimal performance in the neural network.
- **Model tuning:** Several iterations were needed to fine-tune the model's architecture and hyper parameters for improved accuracy.

8. Conclusion

This project demonstrates the process of building and evaluating a neural network for the classification of street view house numbers. The results showcase the model's ability to generalize to new images with an acceptable level of accuracy, though there is room for future improvements.