DETAILED EXPLANATION FOR ML ASSIGNMENT- SUPERVISED REGRESSION: Pixel Coordinate Prediction using Deep Learning

1. Problem Understanding:

The goal of this assignment is to predict the (x, y) coordinates of a single bright pixel in a 50×50 grayscale image. Each image contains only one pixel with intensity 255, while all other pixels are zero. Since the output values are continuous, the problem is treated as a supervised regression task.

2. Dataset Generation:

A synthetic dataset is generated for this problem because the pixel location is random and known during data creation. Each sample consists of a 50×50 image with one bright pixel and corresponding coordinate labels. Pixel values and coordinates are normalized to improve training stability.

3. The reason behind choosing CNN for Regression:

CNNs are effective at extracting spatial features from images. Even though the task is regression, the CNN handles feature extraction, while the final layer outputs continuous (x, y) values using Mean Squared Error loss.

4. Model Architecture:

The model includes convolutional layers, pooling layers, and fully connected layers, ending with a linear output layer that predicts pixel coordinates.

5. Training and Evaluation:

The dataset is split into training and testing sets. Model performance is monitored using training and validation loss curves and evaluated using scatter plots comparing predicted and actual coordinates.

6. Results

The model successfully predicts the pixel location with predictions closely matching the ground truth.

7. Conclusion

This project demonstrates a clear application of deep learning for a supervised regression task involving image data, focusing on correct formulation and understanding rather than accuracy alone.

GitHub: https://github.com/srivasthav-2036/ML-Assignment-Supervised-Regression

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