# DLP Project Report

# Group Members

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**Title:** Image Classification using Convolutional Neural Networks with Dropout Regularization

## Objective:

The primary objective of this project is to develop a robust image classification system using Convolutional Neural Networks (CNNs) with Dropout Regularization. The aim is to achieve high accuracy in classifying images while preventing overfitting, thereby creating a model that generalizes well to unseen data.

## Problem Statement:

Image classification is a fundamental task in computer vision with numerous applications such as medical diagnosis, autonomous driving, and object recognition. However, building an accurate image classifier poses challenges, including the risk of overfitting, where the model learns to memorize training data rather than generalize patterns. This can lead to poor performance on unseen data. Dropout regularization is one technique employed to mitigate overfitting by randomly dropping neurons during training, encouraging the network to learn more robust features.

## Methodology:

**1. Data Collection and Preprocessing:** Acquire a dataset suitable for image classification tasks. Preprocess the data by resizing images, normalizing pixel values, and splitting the dataset into training and testing sets.

**2. Model Architecture:** Design a CNN architecture suitable for image classification. Incorporate dropout layers to prevent overfitting. The model comprises convolutional layers for feature extraction, max-pooling layers for dimensionality reduction, dropout layers for regularization, and fully connected layers for classification.

**3. Training:** Train the CNN model using the training data. Utilize categorical cross-entropy as the loss function, the Adam optimizer for optimization, and monitor accuracy as the evaluation metric. Employ dropout regularization during training to improve generalization.

**4. Evaluation:** Evaluate the trained model on the testing dataset to assess its performance. Measure accuracy, precision, recall, and F1-score to gauge classification performance across

different classes. Additionally, analyze the model's confusion matrix to identify common misclassifications.

**5. Results Interpretation:** Interpret the results to determine the effectiveness of dropout regularization in preventing overfitting and improving classification accuracy. Compare the performance of the CNN model with and without dropout regularization to assess its impact.

## Results:

The results of the project demonstrate the effectiveness of dropout regularization in improving the performance of the image classification model. The CNN model with dropout regularization achieves higher accuracy and generalizes better to unseen data compared to the model without dropout. The evaluation metrics show improved performance in terms of accuracy, precision, recall, and F1-score, indicating the robustness of the dropout-regularized model.

**Base Model Test Accuracy:** 0.6566
**Model_1 Test Accuracy (with Dropouts):** 0.7127
**Model_2 Test Accuracy (with Additional Filters):** 0.7476
**Model_3 Test Accuracy (with Batch Normalization):** 0.8790

## References:

1. Srivastava, Nitish, et al. "Dropout: A simple way to prevent neural networks from overfitting." *Journal of Machine Learning Research* 15.1 (2014): 1929-1958.
2. LeCun, Yann, et al. "Gradient-based learning applied to document recognition."
3. Chollet, François. "Xception: Deep learning with depth wise separable convolutions." 4. Russakovsky, Olga, et al. "ImageNet large scale visual recognition challenge." *International Journal of Computer Vision* 115.3 (2015): 211-252.

This report summarizes the methodology, results, and references for the project on image classification using CNNs with dropout regularization. The findings demonstrate the effectiveness of dropout regularization in enhancing the performance and generalization capabilities of the image classification model.