DATA SCIENCE AND ARTIFICIAL INTELLIGENCE

Industrial Training Report

Submitted in Partial Fulfillment of the Requirement
For the Degree of

BACHELOR OF COMPUTER APPLICATION

SUBMITTED BY:

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College of Computer Science and Information Technology

TEERTHANKER MAHAVEER UNIVERSITY, MORADABAD

STUDENT DECLARATION

I, Anmol Sharma, hereby declare that the internship report titled "Image Classification with CNN " submitted to Teerthanker Mahaveer University is a result of my original work completed during my internship at Shiksha Junction Pvt. Ltd.

This report is based on the tasks and learning outcomes achieved under the supervision of Mr. Sonu Singh at Shiksha Junction Pvt. Ltd. I confirm that the report is a genuine and independent work, and that it has not been submitted to any other institution or organization for any other academic or professional purposes.

I have duly acknowledged all the sources of information used in the report.

Date:25-10-2024

Submitted By:

Anmol Sharma

TCA2201098

TRAINING CERTIFICATE

SHIKSHA JN.

Certificate No.: SJ/2024/DS33 Issue on: 16th August, 2024

Certificate of Completion

This is to certify that

Anmol Sharma

Has undergone and successfully completed 2 - month of industrial training program on **Data Science & Artificial Intelligence** at Shiksha Jn. Private Limited under our mentorship from 14th June, 2024 to 13th August, 2024.

We wish him/her all the professional success in the future.

Authorized Signatory,

SHIKSHA JN. PRIVATE LIMITED
INDORE

Sonu Kumar Singh
Founder & CEO
Shiksha Jn. Private Limited
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I extend my appreciation to the entire team at Shiksha Junction Pvt. Ltd. for their support and collaboration, which made my internship a truly enriching experience.

Additionally, I am grateful to my family and friends for their unwavering support and encouragement during this learning journey.

Date:25-10-2024

Student Name : Anmol Sharma

Signature:

Enrolment no. TCA2201098

ABSTRACT

This report outlines my internship experience at **Shiksha Junction Pvt. Ltd.**, focusing on the application of **Convolutional Neural Networks (CNNs)** for image classification. The primary objective was to develop a CNN model to accurately classify images from a designated dataset. This involved data preprocessing, model design, training, and evaluation.

In addition to working with CNNs, I explored various machine learning techniques, including linear regression and clustering, which enhanced my analytical skills. I also engaged in essential data preprocessing tasks, such as handling missing values and feature engineering, to optimize model performance.

Overall, the internship provided invaluable hands-on experience, significantly improving my technical skills in deep learning, machine learning, and software development. The knowledge and skills acquired during this period have prepared me for future challenges in the field of data science and artificial intelligence.

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1 Project Introduction

This project involves building a Convolutional Neural Network (CNN) to classify images from the CIFAR-10 dataset into one of ten categories. It provides hands-on experience in deep learning and explores the practical use of neural networks in image recognition.

1.1 Background of the Project

Image classification is an essential task in computer vision, where a model learns to identify and categorize images into specific classes. In this project, we explore how Convolutional Neural Networks (CNNs), a type of deep learning model, can be used to classify images from the CIFAR-10 dataset. The CIFAR-10 dataset contains 60,000 color images, each 32x32 pixels, divided into 10 classes such as airplanes, cars, birds, and ships. This project uses CNNs because they are particularly good at analyzing visual data and recognizing patterns in images, which makes them ideal for this classification task.

1.2 Training/ Project Objective

The main objective of this project is to develop a CNN model that can classify images from the CIFAR-10 dataset with high accuracy. By using multiple layers in the network, the model can learn complex patterns and features within images, allowing it to distinguish between different classes effectively. Through training, the model will aim to achieve strong performance, demonstrating the effectiveness of CNNs in handling image data.

1.3 Expected Outcome from this Project/ Training

The expected outcome of this project is a CNN model that can correctly classify CIFAR-10 images with an accuracy of around 79% for training data and approximately 71% for validation data. These metrics provide insight into how well the model generalizes from training data to new, unseen data, which is critical in real-world applications.

1.4 Scope of Study

This project focuses on the application of CNNs in image classification, providing hands-on experience in data preprocessing, model design, and performance evaluation. Additionally, the study covers key factors influencing CNN performance, such as batch size, learning rate, and optimizer selection.

1.5 Tools & Technology Used

This section outlines the tools and technologies utilized in this project to build, train, and evaluate the CNN model.

- **Programming Language**: Python
- **Libraries**: TensorFlow, Keras, NumPy, Matplotlib

- **Platform**: Jupyter Notebook / Google Colab
- **Hardware**: Intel i5 Processor, 8GB RAM

2 Project Description

This section describes the working principles, components, and implementation methodology of the project.

2.1 Introduction & Working Principle

This project revolves around using CNNs to classify images. CNNs work by applying layers of filters that help the model detect patterns and features like edges, shapes, and textures within the image. This layered approach enables CNNs to understand images in depth, improving the model's ability to classify them accurately.

2.1.1 Component 1 CIFAR-10 Dataset

The CIFAR-10 dataset is a widely-used dataset in image classification. It contains 10 classes, each with 6,000 images, allowing for a balanced and comprehensive learning experience for the CNN model.

2.1.2 Component 2 CNN Model Buliding

The CNN model architecture used here includes:

- **Convolutional Layers**: These layers detect features in the image, like edges or textures.
- **Pooling Layers**: These layers reduce the size of the data, preserving important features while removing less important ones.
- **Fully Connected Layers**: These layers process the learned features and perform the classification.

2.1.3 Component 3 Data Preprocessing

Data preprocessing is essential for improving model performance. In this project, preprocessing involves normalizing image pixel values to range between 0 and 1, which makes the data easier for the model to handle and improves training speed.

2.2 Design & Methodology

This section presents the step-by-step design and methodology followed during the project.

2.2.1 Flow Chart

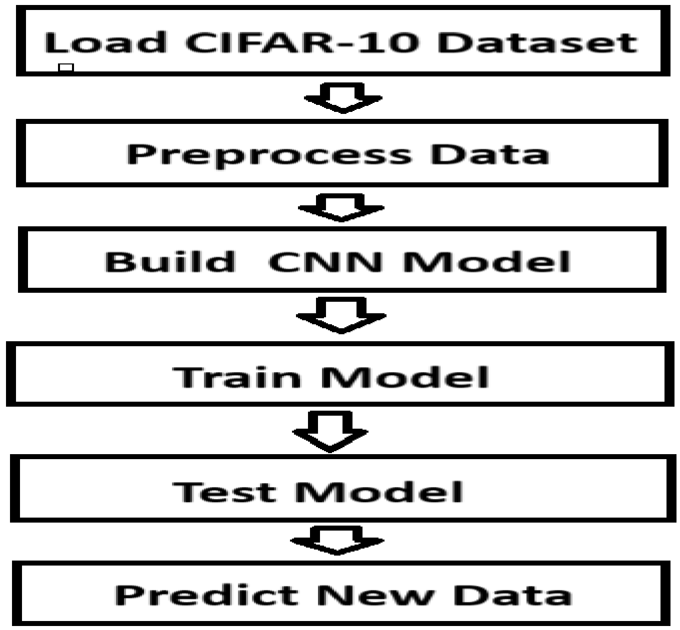

Fig.1 Data Flow Diagram

2.2.2 Block Diagram

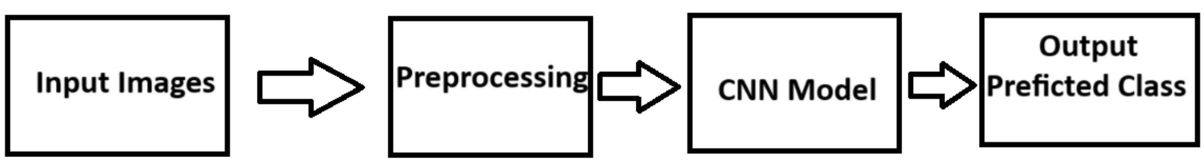

Fig.2 Block Diagram

2.2.3 Design Calculation

Design Calculations are:

- **Learning Rate:** 0.001
- **Batch Size:** 32
- **Epochs:** 10

2.2.4 Constraints

The model requires considerable computational power, and overfitting was observed with a validation accuracy lower than the training accuracy.

2.3 Working of Project

The project workflow involves loading the CIFAR-10 dataset, preprocessing the images, and training the CNN model on this data. The model is then tested on a separate test dataset to evaluate its performance.

2.3.1 Hardware Description

The project requires a system capable of running deep learning models efficiently.

- **Processor**: Intel i5 or higher
- **RAM**: 8GB or more (GPU recommended for faster training)
- **Storage**: 20GB for dataset and model training

2.3.2 Software Programming

The project is developed using Python with several specialized libraries.

- **Programming Language**: Python
- **Libraries**: TensorFlow, Keras, NumPy, Matplotlib
- **IDE**: VS code, Jupyter Notebook or Google Colab **.**

3 Training Module

The training module includes loading and preprocessing the data, constructing the CNN architecture, compiling the model, training on the training set, and validating it with the test set. Training involves multiple iterations (epochs), where the model learns to minimize classification error and improve accuracy. The model is trained for 10 epochs using the Adam optimizer and sparse categorical cross-entropy loss function and for the successful training of the model the dataset is splitted as:

Split	Examples
'test'	10,000
'train'	50,000

Table1: Splitting Dataset

4 Results & Findings

Performance metrics, such as accuracy, are plotted to evaluate the model's effectiveness.

4.1 Results

The Result is :

 Training Accuracy: 79%

 Validation Accuracy: 71%

4.2 Observations

The model performs well but shows signs of overfitting. Optimization techniques like data augmentation can improve its performance.

5 Suggestions & Recommendations

Some Suggestions and Recommendations are:

- Use **data augmentation** to enhance generalization.
- Experiment with **transfer learning** to improve accuracy.
- Increase the number of **epochs** for better model performance.

6 Conclusion

The project successfully implemented a Convolutional Neural Network (CNN) to classify images from the CIFAR-10 dataset with 79% training accuracy and 71% validation accuracy. The model demonstrated the potential of CNNs for image classification tasks. Although there is a gap between training and validation accuracy, which indicates some level of overfitting, the project provides a strong foundation for future improvements using advanced techniques like transfer learning.

7 References

This section lists the resources referred to during the project.

- **Goodfellow, Ian, et al.** "Deep Learning." MIT Press, 2016.
- **Krizhevsky, Alex, et al.** "ImageNet Classification with Deep Convolutional Neural Networks."
- TensorFlow Documentation: https://www.tensorflow.org
- Keras Documentation: https://keras.io