*Convolutional Neural Network for Multiclass Image Classification of Filipino Dishes)*

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*Abstract*— This research aims to develop and evaluate a convolutional neural network (CNN) for the task of multiclass image classification of Filipino dishes. The increasing popularity of Filipino cuisine worldwide has made it necessary to have an automated system for identifying dishes. Traditional methods for dish classification such as manual annotation are time-consuming and prone to errors. With the advent of deep learning, it has become possible to train models that can accurately classify images of dishes.

The dataset used for training and testing the CNN consists of images of various Filipino dishes, with each image labeled according to its dish category. The dataset was collected by the researchers, and it contains a diverse set of images that represent the different dishes from different regions of the Philippines. The dataset was split into training and validation sets with a ratio of 80:20. The CNN architecture and hyperparameters were optimized through a series of experiments to achieve the highest possible classification accuracy. The researchers used TensorFlow and Keras, two popular open-source deep learning libraries, to develop and train the program. The program is written in Python, a popular programming language used in various data analytics related tasks. The performance of the developed CNN was then evaluated using standard metrics such as accuracy, precision, recall, and F1-score. The results of the evaluation demonstrate the effectiveness of the proposed CNN in accurately classifying images of Filipino dishes. The research contributes to the development of a model that can automate the task of identifying Filipino dishes from images, which can have practical applications in the food industry such as in food delivery apps and recipe search engines. The model can also be used in restaurant menus, food festivals, and other related applications. Furthermore, this research can also be used as a benchmark for other food classification tasks.

Keywords—convolutional neural network (CNN), multiclass image classification, Filipino dishes, deep learning, TensorFlow, Keras, Python Jupyter

1. INTRODUCTION

The increasing popularity of Filipino cuisine worldwide has made it necessary to have an automated system for identifying dishes. Traditional methods for dish classification such as manual annotation are time-consuming and prone to errors. Deep learning has made it possible to train models that can properly classify photographs of food. In this study, we propose to develop and assess a convolutional neural network (CNN) for the task of multiclass image classification of Filipino dishes. We will use a dataset of images of various Filipino dishes, with each image labeled according to its dish category. To attain the maximum classification accuracy feasible, the CNN architecture and hyperparameters will be refined through a series of trials. Standard performance measures including accuracy, precision, recall, and F1-score will be used to assess how well the constructed CNN performs. The algorithm will be created and trained by the researchers using TensorFlow and Keras, two well-known open-source deep learning tools. Python, a popular programming language used in various data analytics related tasks. The study will aid in the creation of a model that can automatically recognize Filipino cuisine from photos. This model may find use in the food business, including in recipe search engines and food delivery apps.

1. RELATED LITERATURE
2. METHODOLOGY

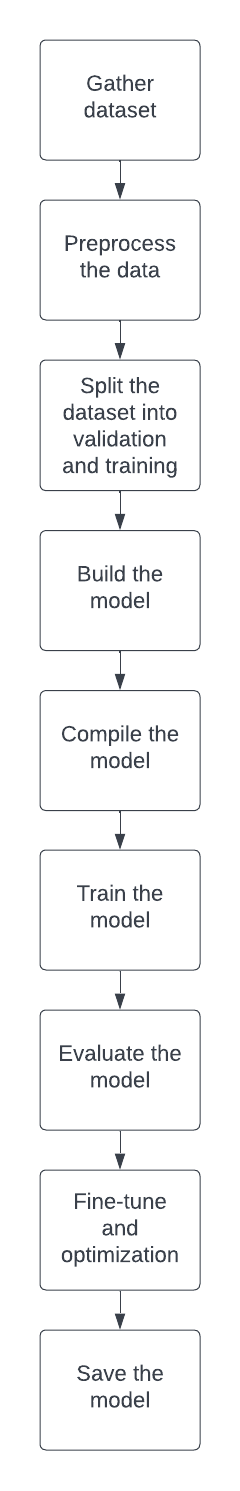
The primary goal of this study is to create and train a CNN model with training and validation accuracy above the given benchmark of 75%. Achieving low training and validation loss is also a priority in the creation of the model.

|  |  |
| --- | --- |
| Table 1. IMAGE DATASET | |
| NAME OF DISH | SIZE OF CLASS |
| Adobo | 945 |
| Pinakbet | 951 |
| Sinigang | 979 |
| TOTAL SIZE | 2875 |

It is important to note that the size of the class (or category) must be roughly the same—or balanced, as imbalanced class size might result to the model being good at recognizing one class, but not the others. The dataset was collected manually through Google images. Preprocessing the data, ie resizing the data, was done through code.

*Image Classifier Model Development*

Building a CNN model is the main objective of this paper. Techniques such as dropout and data augmentation were later introduced to prevent overfitting—when a machine learning model is trained too well on the training data, and as a result, performs poorly on new, unseen data.



*Figure 1. Development Framework*

The methodology employed in this study involved utilizing a flowchart as a blueprint for the creation of the model. The initial step involved obtaining the necessary data through web scraping techniques. Subsequently, the data was preprocessed to eliminate any defective files. This was accomplished through a combination of manual review to identify and eliminate files that were inconsistent with the dataset, as well as implementing code to automatically detect and remove any unusable files. The dataset was split into validation and training with the ratio of 20:80. Training data is used to train a machine learning model to learn patterns in the data, while validation data is used to evaluate the model's performance on unseen data, giving an estimate of how well it will perform on new data. The model architecture followed the convention of three convolutional layer, and later optimized through regularization techniques and a series of experimentation.

*Importing the Dataset*

In order to obtain the dataset, we employed Tensorflow's Keras method for loading image datasets from a directory. A validation split of 20% was utilized, with the validation set comprising of 20% of the overall dataset. The image size was subsequently adjusted using the image\_size parameter to the appropriate dimensions. *Text

Description automatically generated*



*Figure 2.1. Training Dataset*

Text

Description automatically generated

A screenshot of a computer

Description automatically generated with low confidence

*Figure 2.2. Validation Dataset*

*Building the Model Architecture*

*Prevent Overfitting*

*Optimize the Model*

*Save the Model*

1. RESULT

The outcome of this study aims to create a model that attains a 75% accuracy. The results and discussion section will focus on analyzing the effectiveness of the model in achieving this goal.