

INTRODUCTION

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that there must always be at least one input layer in an artificial neural network. This layer would be in charge of receiving the data. Then, the neurons would do calculations on the input data before sending it to the hidden layer. The hidden layer would take in a set of weighted inputs. Finally, the output layer would be the last layer of neurons that would produce outputs.

There were many types of artificial neural networks. They were classified based on their structure, data flow, neurons, layers, etc. Since each type of artificial neural network had their differences, each type also had their own strengths. According to the study by Mehta (2022) entitled "A Comprehensive Guide to Types of Neural Networks," it was stated that such types of artificial neural networks include Feedforward Neural Network, Radial Basis Function Neural Network, Multilayer Perceptron, Convolutional Neural Network, Recurrent Neural Network, Modular Neural Network, and Sequence-To-Sequence Models. But of all these types, convolutional neural networks were the most effective in image recognition. Convolutional Neural Network (CNN)

A convolutional neural network was a type of artificial neural network. According to the study by Mishra (2020) entitled "Convolutional Neural Networks, Explained," a convolutional neural network (CNN), or ConvNet, specializes in processing data that has a grid-like topology, such as an image. A convolutional neural network typically has three layers: a convolutional layer, a pooling layer, and a fully connected layer, where the convolutional layer was its core building block. As stated above, a convolutional layer was a fundamental component of a convolutional neural network. It would be responsible for performing feature extraction on input data, particularly images. Feature extraction in convolutional neural networks

RESEARCH OBJECTIVES

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Therefore, based on the findings stated, the researchers came up with "Dinder: A Dog Matching Web-Based Application Using Convolutional Neural Networks with EfficientNetB0 Transfer Learning" to classify dog breeds, coat colors, and types, and provide image display of their offsprings in a way that would significantly reduce time and work. Also, this could potentially result in more precise results of searching for a matching dog partner.

Specifically, the study aimed to answer the following research problems: (1) How to design and develop a dog matching web application prototype with image recognition of breeds, coat colors, and types as well as image display of offsprings for Labrador Retrievers, Pomeranians, Poodles, Pugs, and Shih-Tzus? (2) How to conduct model evaluation based on the accuracy, precision, recall, and F1-score of pre-trained

CNN models, ResNet50, VGG16, and EfficientNetB0, with distinct numbers of parameters, to determine which transfer learning model to integrate? (3) How to examine the performance of the models developed integrated into the prototype through actual testing?

Research

Objectives

Generally, the study aimed to design and develop a prototype for dog matching in the form of a web application integrated with deep neural networks, particularly transfer learning-based convolutional neural network (CNN) models, with the transfer learning model selected through evaluations of several pre-trained CNN models having distinct numbers of parameters or weights for the benefit of dog owners in potentially reducing the time and effort taken to search for a preferred dog partner for their dogs. Specifically, this study sought:

LITERATURE OF THE STUDY

Hardware	and		Software	Resources
Hardware				
●	1.00	TB	Disk	Storage
●	8.00		GB	RAM
● Intel®	Core™	i3	-1115G4	Processor
Software				
●	Visual	Studio	Code	1.73.1
●				Figma
●		SQLite		2.2.0
●		Google		Colab
●		Python		3.10.7
● Git 2.38.0				

METHODOLOGY - Research Design

CHAPTER

III

RESEARCH

METHODOLOGY

In this chapter, the methodologies employed by the researchers to accomplish the objectives of the study would be presented. It would enumerate the research design, fact-finding technique, algorithm analysis, data model generation, model evaluation, image recognition, offspring image display, development methodology, prototype actual testing, and software used in the development. Research Design

This study was conducted with the use of experimental and developmental research design methods. As stated by Arikunto (2006), an experimental research design was a study that aimed to know if there was an effect on the variable being studied. This method was utilized in order to determine the best-performing pre-trained convolutional neural network model in terms of image classification with respect to the

datasets collected. Furthermore, as defined by Richey (1994), developmental research was the systematic study of designing, developing, and evaluating instructional programs, processes, and products that must meet the criteria of internal consistency and effectiveness. The researchers used developmental research to determine the features to be developed for the system. It was also used to assess the system's consistency and efficacy during development.

METHODOLOGY - System Development Methodology

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There were many SDLC models to be used for software development, each with their own strengths and weaknesses, but the Rapid Application Development (RAD) model was chosen for the development of this study. According to Dopico (2019), RAD was a form of agile software development methodology that prioritizes rapid prototype releases and iterations. As a result, it could deliver developed software and make changes quickly while aiming to deliver a product that more closely fits the needs of the user through consistent testing and tweaking. The process of RAD as shown in the figure above consisted of four (4) main phases that steer the development process. The processes of the researchers during the phases of analysis and quick design, prototype cycles, testing, and implementation, were discussed in the following:

Analysis and Quick Design

In this phase, the researchers defined the requirements, scope, and goals of the web application, Dinder. Through intensive brainstorming and research from existing matching applications, the researchers were able to determine the features developed. With the requirements set out, the researchers then set up meetings in order to determine the scope and goals of the study which included the timeline of the development.

Prototype Cycles

The researchers started building out the prototype during this phase. Due to the lengthy process of gathering cross breed dog images for the online application, this phase took quite some time. This phase continued until the researchers determined that the product was ready to be finalized.

RESULTS AND DISCUSSION - Overall Record of Actual Testing

ISO Forms

RESULTS AND DISCUSSION - RESEARCH OBJECTIVE 1:

Dataset Screenshots

RESULTS AND DISCUSSION - RESEARCH OBJECTIVE 2:

```
● six==1.16.0
● SQLAlchemy==1.4.42
● tensorboard==2.8.0
● tensorboard -data-server==0.6.1
● tensorboard -plugin -wit==1.8.1
● tensorflow==2.8.0
● tensorflow -io-gcs-file-system==0.27.0
● termcolor==2.1.0
● tf-estimator -nightly==2.8.0.dev2021122109
● typing_extensions==4.4.0
● urllib3==1.26.12
● Werkzeug==2.2.2
● wrapt==1.14.1
```

RESULTS AND DISCUSSION - RESEARCH OBJECTIVE 3:

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Figure 36. Black pug and black shih -tzu possible offspring images.

The possible offspring images for black pug and black shih -tzu returned by the prototype seemed logical upon observation.

CONCLUSION

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CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter would briefly discuss the summary of findings, conclusions, and recommendations for future researchers that were reached by this study's researchers after conducting their research.

Summary

The study aimed to design and develop a dog matching web application prototype as well as image display of offsprings for Labrador Retrievers, Pomeranians, Poodles, Pugs, and Shih -Tzus. During the course of the study, the researchers discovered that in most of the studies, the ResNet50 pre -trained model always outperformed the other pre -trained models with the large datasets the other researchers used. Moreover, through the intense reading of various literature regarding deep learning, particularly artificial neural networks, the researchers learned that there was

more to Artificial Intelligence (AI) than simply focusing on machine learning algorithms. Most importantly, the researchers discovered that one cannot simply apply any pre-trained models to their model just because it was said to be the most accurate several factors, especially the size of the dataset affect accuracy.

Conclusions

Based on the findings of the study from the objectives, the researchers have reached the following conclusions and generalizations:

1. In developing the prototype, the researchers discovered that the use of Flask as the backend framework for the prototype fit very well with the RAD software development methodology's quick process of development.

RECOMMENDATIONS

APPENDIX

C

Curriculum Vitae