INNOMATICS RESEARCH LABS

INNOVATION. AUTOMATION. ANALYTICS

PROJECT ON

Image Classification using CNN: Ice-Cream vs Pizza

A Deep Learning Project

Done By: Anuradha K

About me

- **Background ? (B-tech or M-tech)**

B.Arch Graduate

- **Why you want to learn Data Science**

I enjoy learning new things, and data science is a field that's always growing and changing. I want to add new skills like data analysis, programming, and machine learning to my skill set.
In architecture, we often make choices based on design principles. I'm excited to learn how to make decisions based on data, which can provide more precise and impactful results.

- **Any work experience**

No work experience.

- **Share your linkedin and github profile urls**

Anuradha Kilaparthi | LinkedIn
anuradhak0801 (Anuradha K) (github.com)

PROBLEM STATEMENT AND USE CASE DOMAIN

Problem Statement:

The task is to build a system that can automatically distinguish between images of ice cream and pizza using deep learning techniques. Given the visual similarity and variety in food presentation styles, traditional methods struggle with reliable classification. Therefore, a more robust solution is needed that can learn intricate visual patterns directly from image data.

Use Case Domain:

This project falls under the domain: Computer Vision in Food Recognition

Some examples of applications are :-

- Food recognition/Food Tech
- Consumer Apps/Mobile AI
- Marketing and Retail
- AI Research/Educational Projects

OBJECTIVE

The goal of this project is to:

- The goal of this project is to build a binary image classification model that can differentiate between images of Ice Cream and Pizza.
- This problem showcases how Convolutional Neural Networks (CNNs) can be used to learn visual patterns from food images.

Computer vision models like this one can be applied in restaurant apps, food tracking tools, or automated menu scanners.

DATA OVERVIEW

The dataset contains images categorized into two classes: Ice Cream and Pizza.

The data is split into three sets:

- Training set: For learning
- Validation set: For tuning
- Test set: For evaluation

All images were resized to 64x64 pixels with 3 colour channels (RGB) for uniform input to the model.

Class labels are encoded as binary values (0 [ice cream] or 1 [pizza]).

```
Found 718 images belonging to 2 classes.
Found 208 images belonging to 2 classes.
Found 106 images belonging to 2 classes.
```

EDA AND DATA AUGMENTATION

- Dataset directories are well-structured with a balanced number of images in each class.
- Images have varying orientations, lighting, and backgrounds — which adds complexity.
- Visualized a few sample images from each class to confirm quality and variety.

There’s potential for overfitting due to limited diversity without augmentation.

Boosting Data with Augmentation:

To improve generalization, used ImageDataGenerator for data augmentation.

Augmentations included:

- Rotation (up to 40°)
- Zoom and brightness adjustments
- Width/height shift and shear
- Horizontal flips

This made, training data more robust and reduced overfitting risk.

INNOMATICS RESEARCH LABS

MODEL BUILDING

Model Architecture:

Built a Sequential CNN model using TensorFlow/Keras.

Architecture:

Input Layer: 64x64x3

- 2 Convolutional Layers (64 filters, 3x3 kernel, ReLU)
- Max Pooling + Dropout (30%) after each conv layer
- Flatten Layer
- Dense Layer with 256 units + Dropout (50%)
- Output Layer: 1 neuron with Sigmoid activation for binary classification
- L2 Regularization was applied to reduce overfitting.

MODEL BUILDING AND TRAINING

Compilation and Training:

- Loss Function: Binary Crossentropy
- Optimizer: Adam with learning rate = 0.0005
- Metrics: Accuracy
- EarlyStopping was used to halt training after 3 epochs of no improvement.
- Training Duration: Up to 20 epochs
- Batch Size: 64

Training vs Validation Performance:

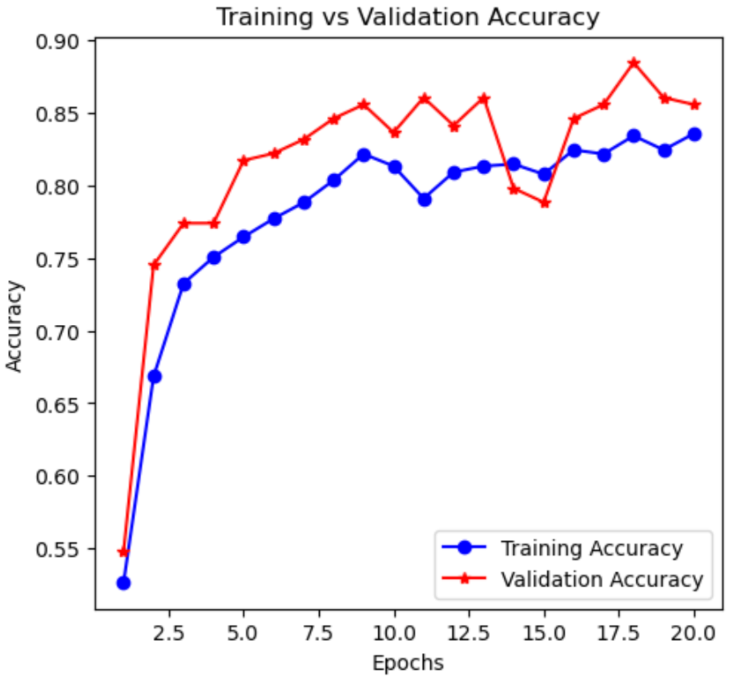
Training Accuracy: steadily improved

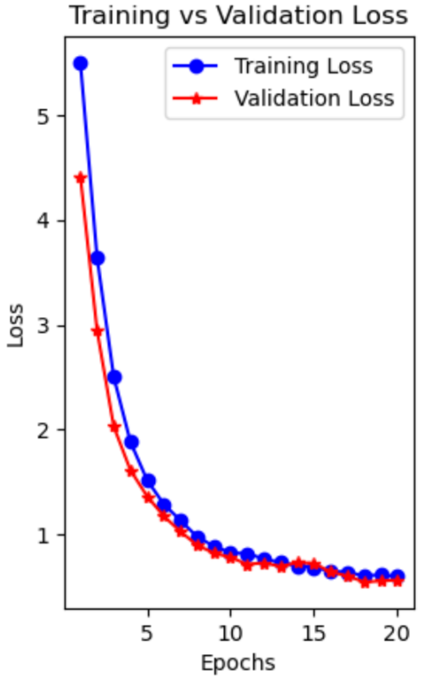
Validation Accuracy: slightly higher than training

Early stopping helped in choosing the best model.

Loss Curves: Training and validation losses decreased over epochs, indicating effective learning.

MODEL BUILDING AND TRAINING





- Both **training and validation loss** decreased steadily over the epochs.
- The model is learning well. The loss is reducing consistently, which indicates effective optimization.
- Validation loss closely follows training loss without increasing, which means the model is generalizing well to unseen data.

- Both **training and validation accuracy** improved over time.
- The model's accuracy increased quickly in the early epochs and then gradually improved.
- Validation accuracy is consistently higher than training accuracy. This can happen due to strong regularization and dropout, preventing overfitting.

INNOMATICS RESEARCH LABS

MODEL EVALUATION

Evaluation:

Final testing was done on the unseen test set.

Results:

Test Accuracy: 0.84

- The model performs well in distinguishing between ice cream and pizza images.
- Minor misclassifications possibly due to image noise or overlapping features.

Saving the model:

Saved the trained model as my_model.keras.

Benefits of saving:

- Easily reusable for prediction or deployment
- Can be loaded later for continued training or fine-tuning
- This enables easy integration into applications or APIs.

Test Data Accuracy: 0.839622641509434

	precision	recall	f1-score	support
0	0.84	0.88	0.86	59
1	0.84	0.79	0.81	47
accuracy			0.84	106
macro avg	0.84	0.83	0.84	106
weighted avg	0.84	0.84	0.84	106

INNOMATICS RESEARCH LABS

Key Business Question

"Can we automatically and accurately classify food images to support applications in food delivery, calorie tracking, or smart restaurant systems?"

Conclusion (Key finding overall)

- CNNs are highly effective for binary image classification tasks.
- Data augmentation significantly improved model generalization.
- Early stopping prevented overfitting and reduced training time.

Your Experience/Challenges Working On The Deep Learning Project

Challenges:

- Tuning hyperparameters like dropout rates and learning rates.
- Managing overfitting through early stopping and regularization.

Learnings:

- Gained hands-on experience with building and training CNN model.
- Learned how to preprocess and augment image data.
- Regularization techniques significantly enhance generalization
- EarlyStopping prevents unnecessary training cycles

INNOMATICS
RESEARCH LABS

THANK YOU

INNOMATICS RESEARCH LABS