



# AI-Driven Food Nutrition Predictor (Predicting Macro Nutritional Content of Food via Deep Learning)

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# The Opportunity

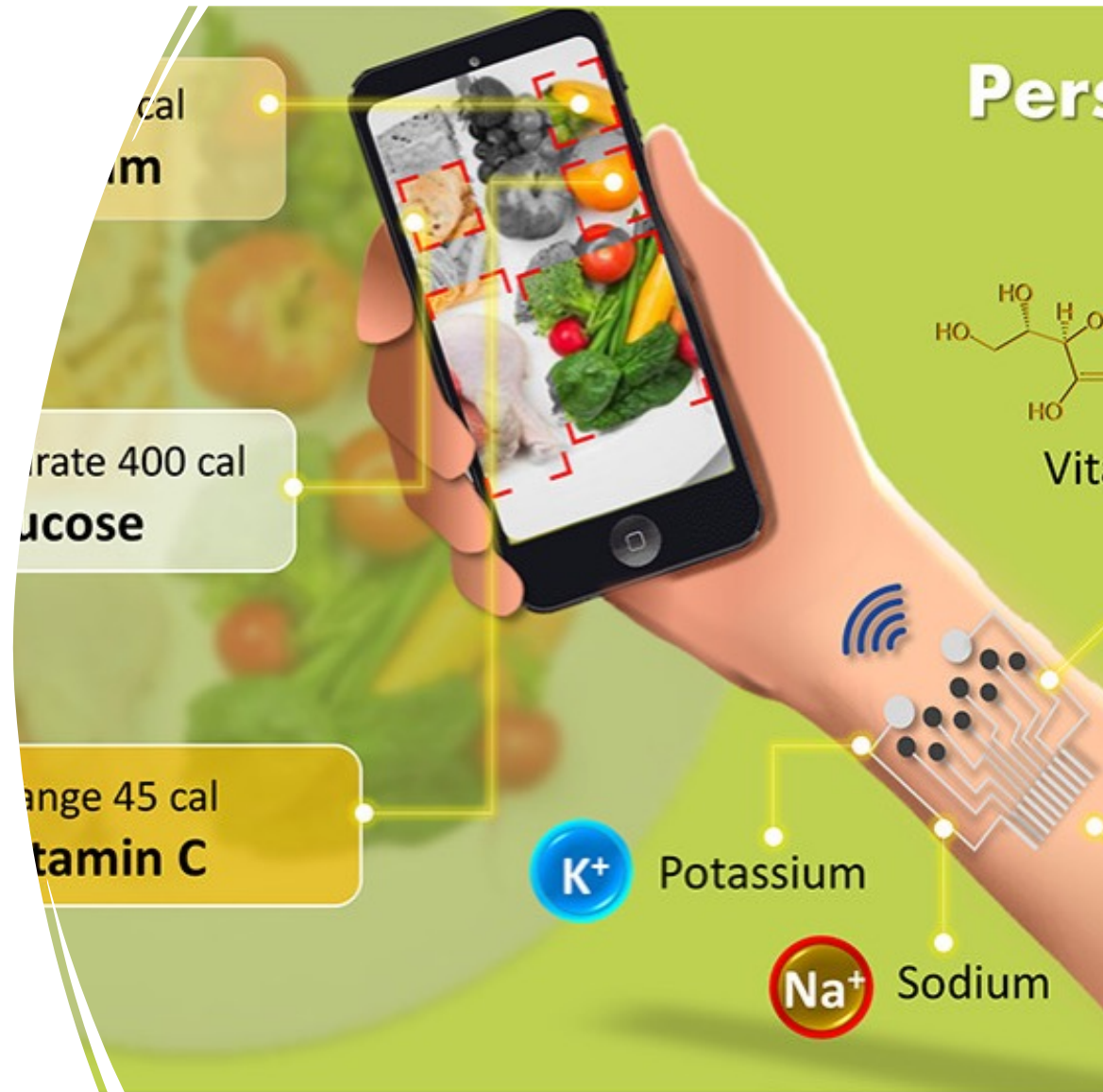
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- Lack of accessible tools to accurately measure nutritional content.
- Growing interest in health and fitness tracking.
- **Target Audience:** Fitness enthusiasts, health-conscious individuals, dieticians.

# Our Solution:

## NutriTrack

- **Core Features:** Estimates food grade in real time.
- **Integration:** Syncs with wearables like Fitbit for holistic health tracking.
- **Impact:** Simplifies nutrition management for health-conscious individuals.

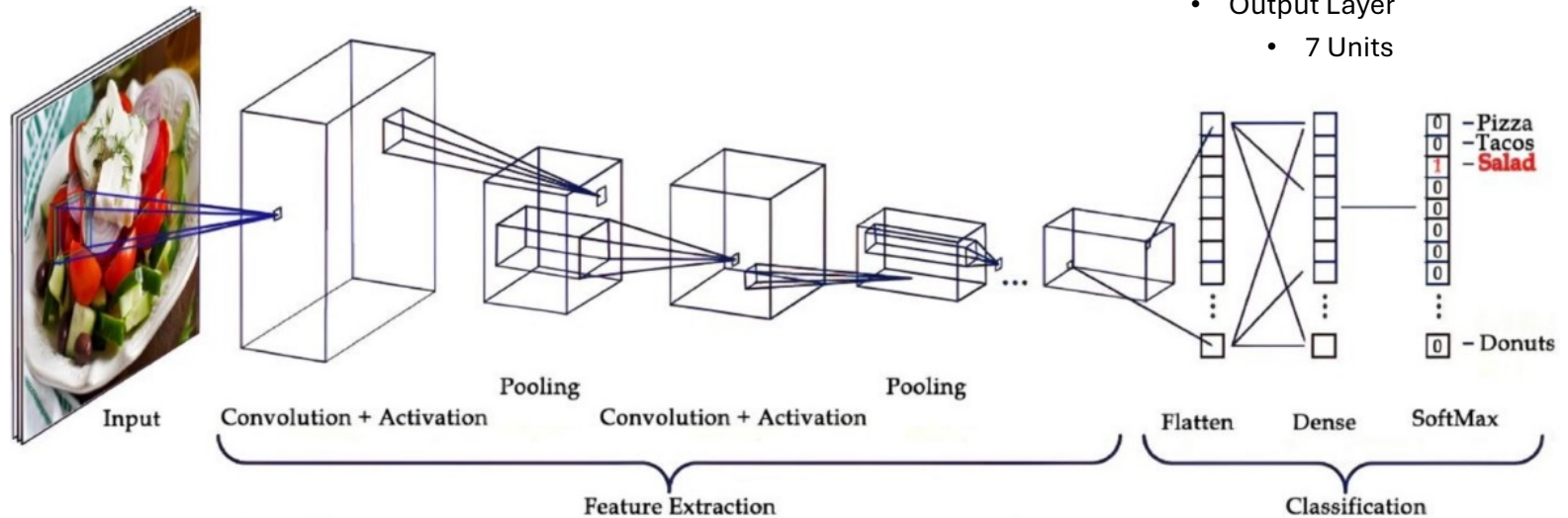




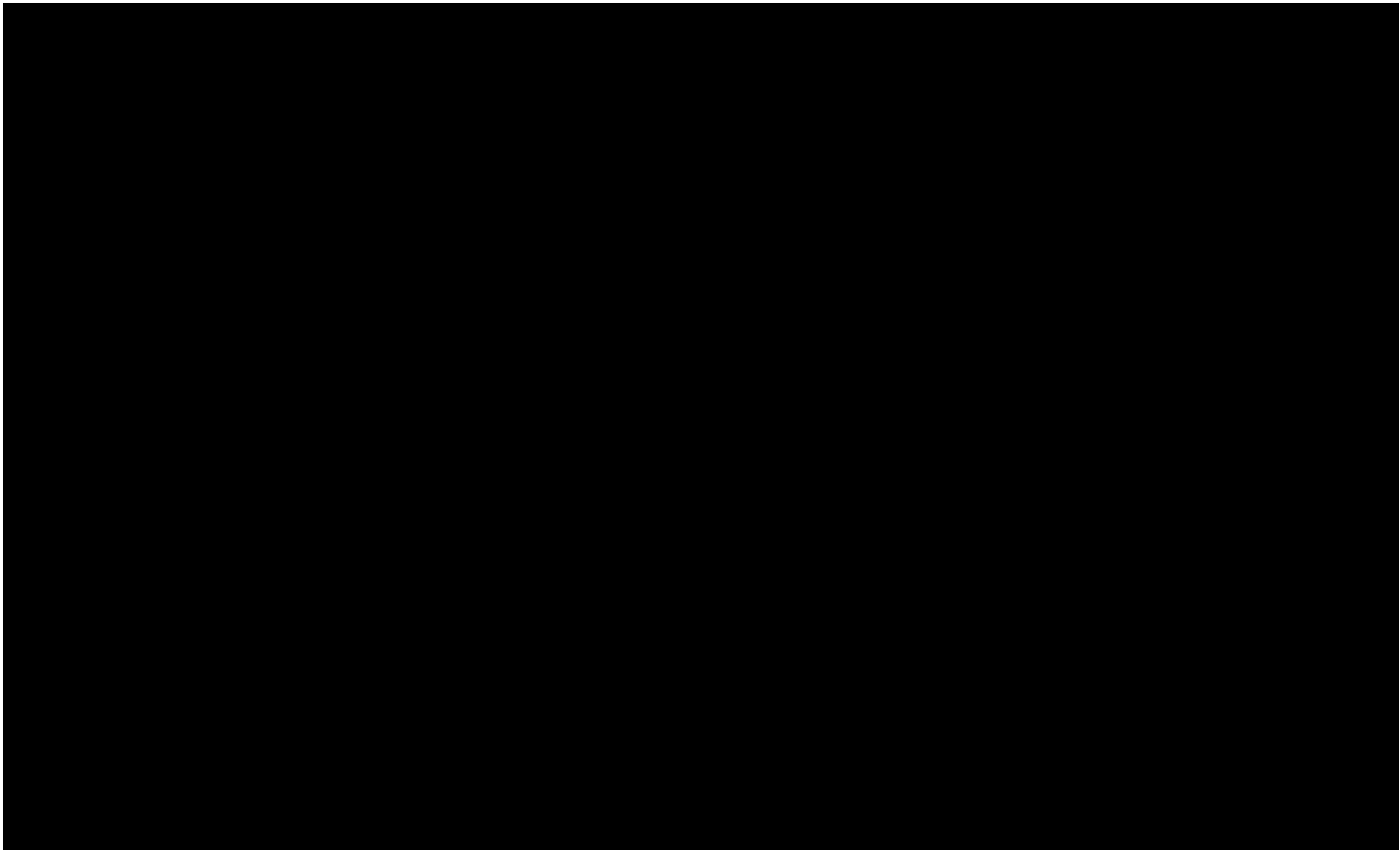
# Technical Framework

- Input:
  - IMG Height
  - IMG Width
  - 3 RGB colors
- Output:
  - 7 Food Grades.

- Model:
  - 1<sup>st</sup> CNN Layer
    - 8 Filters, 4\*4 Kernel, Activation: ReLU
    - Max Pool (2\*2)
  - 2<sup>nd</sup> CNN Layer
    - 8 Filters, 3\*3 Kernel, Activation: ReLU
    - Max Pool (2\*2)
  - Flattening Layer
  - 1<sup>st</sup> Dense Layer
    - 16 Units, Activation: ReLU
  - Dropout Layer
    - 30%
  - Output Layer
    - 7 Units

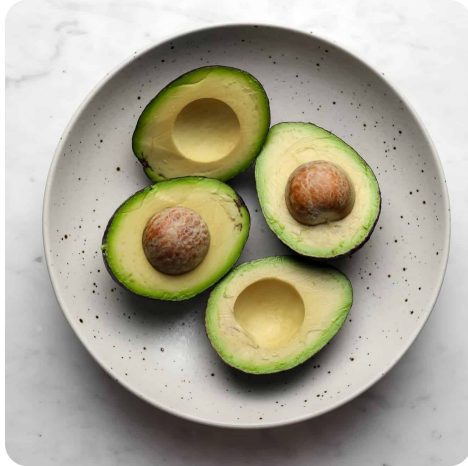


# The Process



# CNN Model

```
...abhi\OneDrive\Bentley\Bentley University\Fall 2024\MA 707 Machine Learning\Group project\CNN_v2.py
[CNV_v2.py x]
192 import glob
193 import pandas as pd
194 import numpy as np
195 from tensorflow.keras.models import Sequential
196 from tensorflow.keras.layers import Dense, Flatten, Dropout, Input, Conv2D, MaxPool2D
197 from tensorflow.keras.preprocessing.image import ImageDataGenerator
198 from tensorflow.keras.callbacks import EarlyStopping
199 from sklearn.preprocessing import LabelEncoder
200 import matplotlib.pyplot as plt
201 from tensorflow.keras.optimizers import RMSprop
202 from tensorflow.keras.utils import to_categorical
203
204 # Paths and settings
205 os.chdir("C:/Users/abhi/OneDrive/Bentley/Bentley University/Fall 2024/MA 707 Machine Learning/Group pro
206 IMG_HEIGHT, IMG_WIDTH = 128, 128 # Reduced resolution for computational efficiency
207 batch_size = 70
208 train_folder = "C:/Users/abhi/OneDrive/Bentley/Bentley University/Fall 2024/MA 707 Machine Learning/Gro
209 test_folder = "C:/Users/abhi/OneDrive/Bentley/Bentley University/Fall 2024/MA 707 Machine Learning/Gro
210
211 # Load and preprocess the new CSV file (dishes_with_grade.csv)
212 df = pd.read_csv('dishes_with_grade.csv')
213
214 # Encode Grade as integers, then one-hot encode
215 le = LabelEncoder()
216 df['Grade'] = le.fit_transform(df['Grade'])
217 grades = to_categorical(df['Grade'])
218 dish_labels = {str(row['dish_ID']): grades[idx] for idx, row in df.iterrows()}
219
220 # Calculate class weights
221 class_frequencies = np.array([1041, 661, 499, 383, 607, 19, 52]) # Example frequencies, replace with yo
222 total_samples = np.sum(class_frequencies)
223 inverse_frequencies = total_samples / class_frequencies
224 normalized_class_weights = inverse_frequencies / np.sum(inverse_frequencies) # Normalize weights
225
226 # Custom generator to load images and labels
227 def custom_image_generator(folder_path, labels_dict, img_height, img_width, batch_size):
228     """
229     Generator for loading images from a folder and corresponding labels in batches.
230
231     Args:
232         folder_path (str): Path to the folder containing subfolders with images.
233         labels_dict (dict): Dictionary mapping dish_ID to labels.
234         img_height (int): Height of resized images.
235         img_width (int): Width of resized images.
236         batch_size (int): Number of samples per batch.
237
238     Yields:
239         images, batch_labels: Arrays of images and corresponding labels.
240     """
241     subfolders = sorted(os.listdir(folder_path)) # Ensure consistent order
242     while True:
243         images = []
244         batch_labels = []
245         for subfolder in subfolders:
246             subfolder_path = os.path.join(folder_path, subfolder)
247             image_files = glob.glob(os.path.join(subfolder_path, '*.jpg'))
248             for image_file in image_files:
249                 image = image_loader(image_file)
250                 image = image.resize((img_width, img_height))
251                 images.append(image)
252                 batch_labels.append(labels_dict[str(row['dish_ID'])])
253                 if len(images) == batch_size:
254                     yield images, batch_labels
255                     images = []
256                     batch_labels = []
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# Proof of Concept

- **Food Image Analysis:** Predicts Food Grades using photos.
- **Real-Time Predictions:** Instant feedback to aid dietary choices.
- **Wearable Integration:** Syncs with Fitbit and similar devices for a complete health tracking experience.
- **Customizable Logging:** Allows users to save and track their meals over time.
- **Truly Customizable:** Unlike following a generic diet plan on the web, users would be empowered with information that is generated on wearables in conjecture with NutriTrack.

# Model Dictionary & Results

Ideal Macro Ratios	
Fat to Protein	0.5 to 2
Carb to Protein	0.5 to 2

Points Based on Deviation	
Ideal	+10
Very High C/P Ratio	-5
Very High F/P Ratio	-10

Results	
Unseen Picture	Predicted Grade
Avocado	B
Pasta	B
Fruit Bowl	B
Unhealthy Food	C

Grade Mapping	
Food Grades	Score
A+	20
A	10
B	5
B+	0
C	-5
D	-1
F	-15

1/1 ————— 0s 17ms/step  
Image: Avocado.jpg - Predicted Grade: B  
Image: Pasta.jpg - Predicted Grade: B  
Image: Turkey-Fruit-Plate.jpg - Predicted Grade: B  
Image: Unhealthy Food.jpg - Predicted Grade: C





## Why Us?

- **Competitors:** Calorie Mama, Bite AI, Foodvisor, and Diet Camera AI
- **Differentiators:** Unlike most competitors, our focus is on integrating with wearables like Fitbit and offering a unique selling point for seamless activity and dietary monitoring.



# Business Potential

- Partnership with Wearable Brands.
- **Fitness apps market:**
  - Expected to grow at CAGR of 21.6% from 2021 to 2028.
  - Expected to continue growing at a CAGR of 29.95%, reaching USD 56.29 billion by 2030.
- **Global wellness apps market:**
  - Size was estimated at USD 9.67 billion in 2023
  - Projected to grow at a CAGR of 15.1% from 2024 to 2030



# Responsible AI

- **User Data Privacy:**
  - User Data Encryption
  - Possibility to go Incognito
  - Opt-in to Share Data
- **Proactive Ethics:**
  - Transparency about rating scales
  - Encourage consults with physicians
- **Caution:**
  - No dieting behavior nudging
  - No claims of authority or expertise



# Impact

## **Individual:** Healthier Lifestyle

- Accountability for personal goals
- Follow-through on provider advice

## **Society:** Fitness & Wellness trends

- Community-building & dish-sharing
- Intercultural, global connections



# Legal



## **Compliance:**

Entertainment purposes  
No need for FDA approval



## **Safety:**

User discretion  
Ingestion risks



## **Intellectual Property:**

Trademarks  
Copyrights



# Next Steps



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Improving Accuracy of food grade  
and predict macro nutrients.

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Building a User-Friendly App  
Interface.

---

Partnership Outreach with Fitbit,  
etc.



What are we  
eating tonight?

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