TEAM SERVER GEEKS

# MACHINE LEARNING

## MEAL NUTRITION ANALYSIS

TEAM SERVER GEEKS - CSCE 633 FINAL PROJECT

# PROBLEM STATEMENT

- Address the need for scalable, accurate calorie estimation in tackling diet-related health issues.
- Mention traditional methods' limitations (e.g., manual tracking, inaccuracy).

# OBJECTIVE

- Build a multimodal machine learning model to estimate lunch calorie intake using diverse data modalities.



# DATASET OVERVIEW

## MEAL IMAGES

**TRAINING**

img_train.csv

**TESTING**

img test.csv

## DEMOGRAPHICS AND GUT HEALTH

**TRAINING**

demo viome train.csv

**TESTING**

demo viome test.csv

## CONTINUOUS GLUCOSE MONITOR (CGM) DATA

**TRAINING**

cgm train.csv

**TESTING**

cgm test.csv

## LABELS FOR LUNCH CALORIES

**TRAINING**

label train.csv

**TESTING**

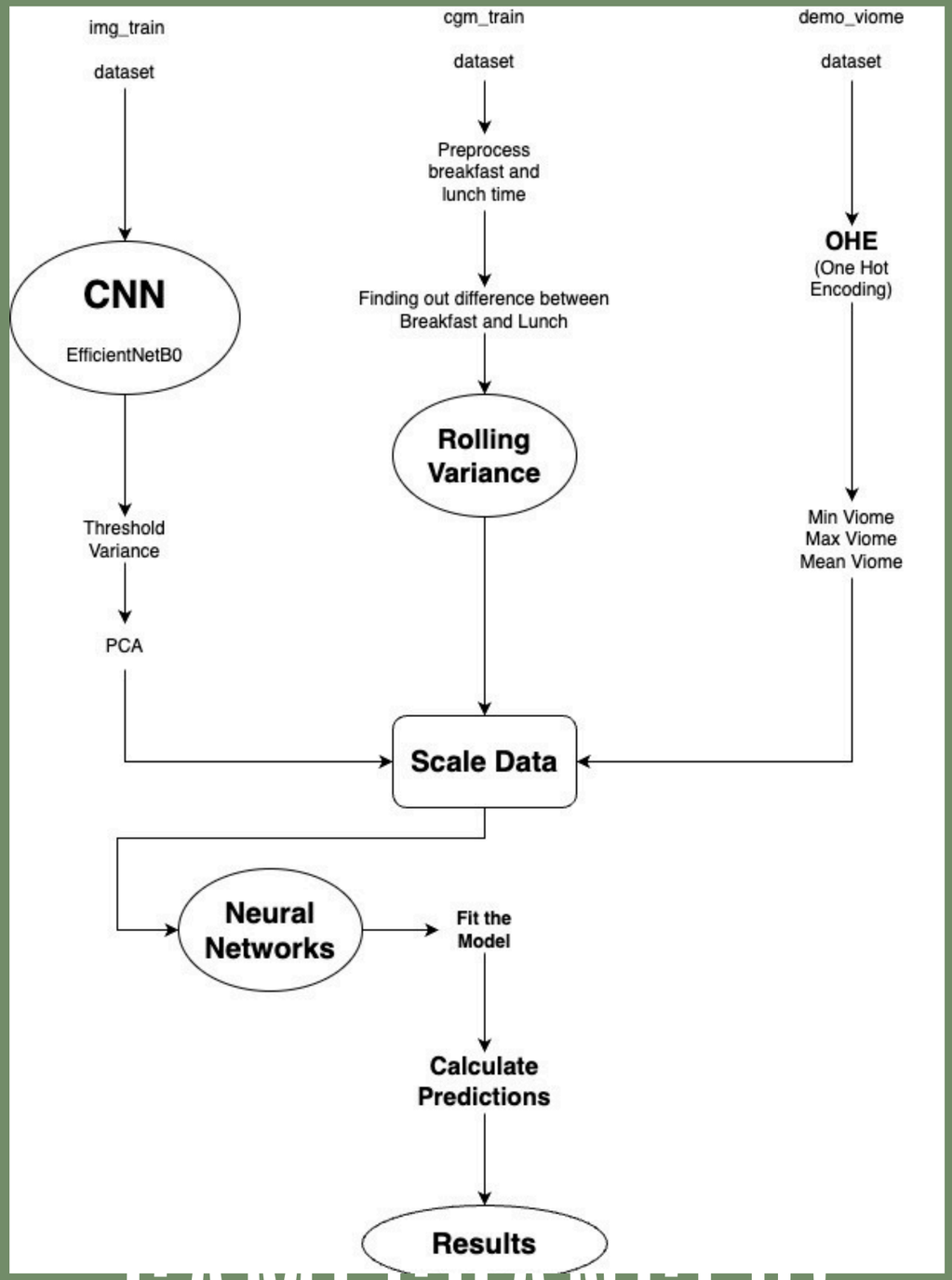
label test breakfast only.csv

# MODEL ARCHITECTURE

This model architecture integrates multiple components to predict lunch calories efficiently:

1. **CNN (EfficientNetB0):** Processes meal images to extract essential features while reducing irrelevant details using PCA for efficiency.
2. **Rolling Variance:** Captures glucose fluctuations between meals, providing insights into metabolic activity.
3. **One-Hot Encoding (OHE):** Converts categorical demographic data into a machine-readable format.

All these outputs are scaled and merged into a unified dataset, which is then passed into a **Neural Network**. The network learns patterns across these features to make accurate calorie predictions using RMSRE as the loss function.

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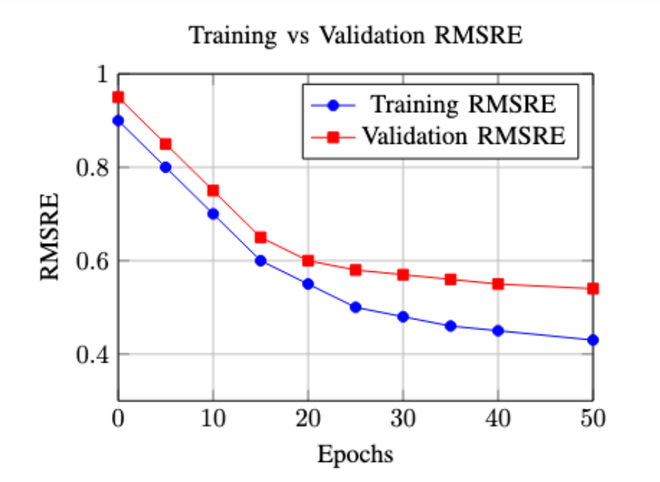
GAMECHANGER!

# MODEL TRAINING AND EXPERIMENTS

## We used RMSRE loss function to evaluate performance.

$$RMSRE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(\frac{\hat{y}_i - y_i}{y_i})^2}$$

## Training vs. validation curve visualization.



# CHALLENGES AND SOLUTIONS

| CHALLENGES | | SOLUTIONS |
|---|---|---|
| • Handling heterogeneous data modalities. | ⟶ | • PCA for dimensionality reduction. |
| • Dimensionality reduction for image embeddings. | ⟶ | • Rolling variance to capture glucose dynamics. |
| • Temporal feature extraction from CGM data. | ⟶ | • Data imputation techniques for missing values. |

# FUTURE SCOPE

01 Dataset expansion to improve generalization.

02 Incorporate attention mechanisms for better modality interaction.

03 Explore other CNN architecture like ResNet with fine tuning

# DEVELOPERS


## KANISHK CHHABRA
kanishk.chhabra@tamu.edu



## PRIYAL KHAPRA
priyalkhapra@tamu.edu



## DISHANT PARAG ZAVERI
dishant.zaveri@tamu.edu