50.039 DL

BLOOD GLUCOSE PREDICTION

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INTRODUCTION

- **This project focuses on predicting future blood glucose levels in diabetic patients using historical glucose, insulin, carbohydrate, and smartwatch activity data.**

- **The dataset used is from the BrisT1D Blood Glucose Prediction Competition on Kaggle.**

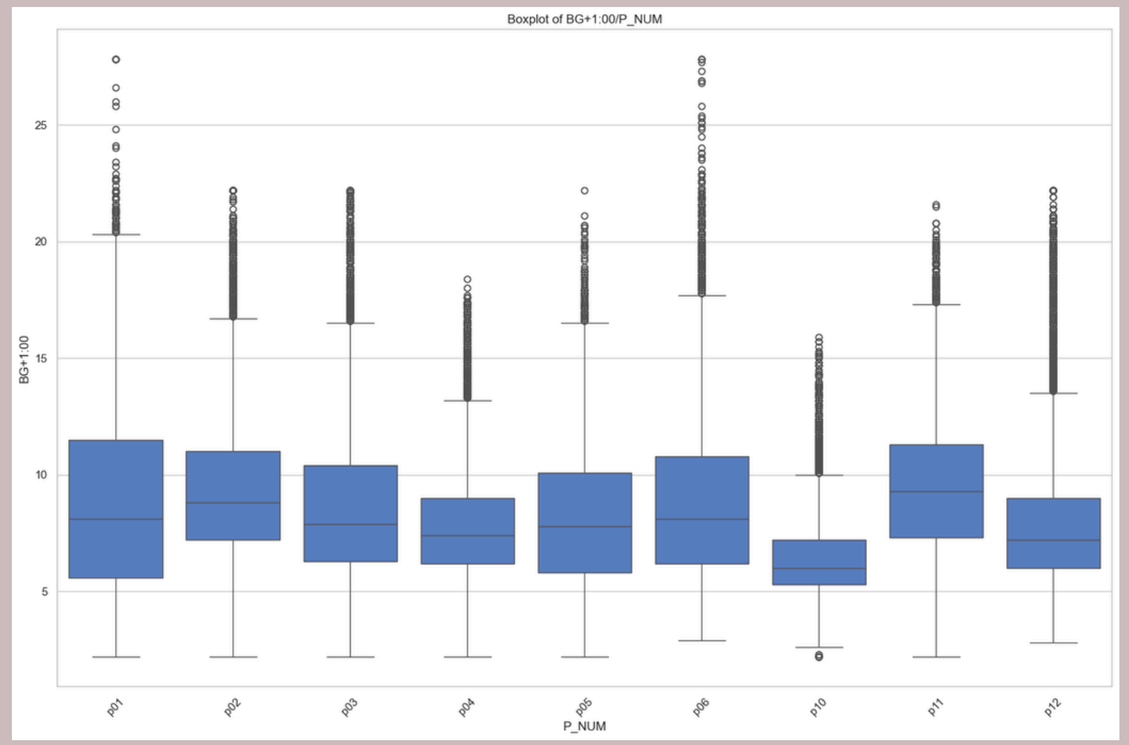
- **Link: https://www.kaggle.com/competitions/bris t1d/data**

DATA PROCESSING

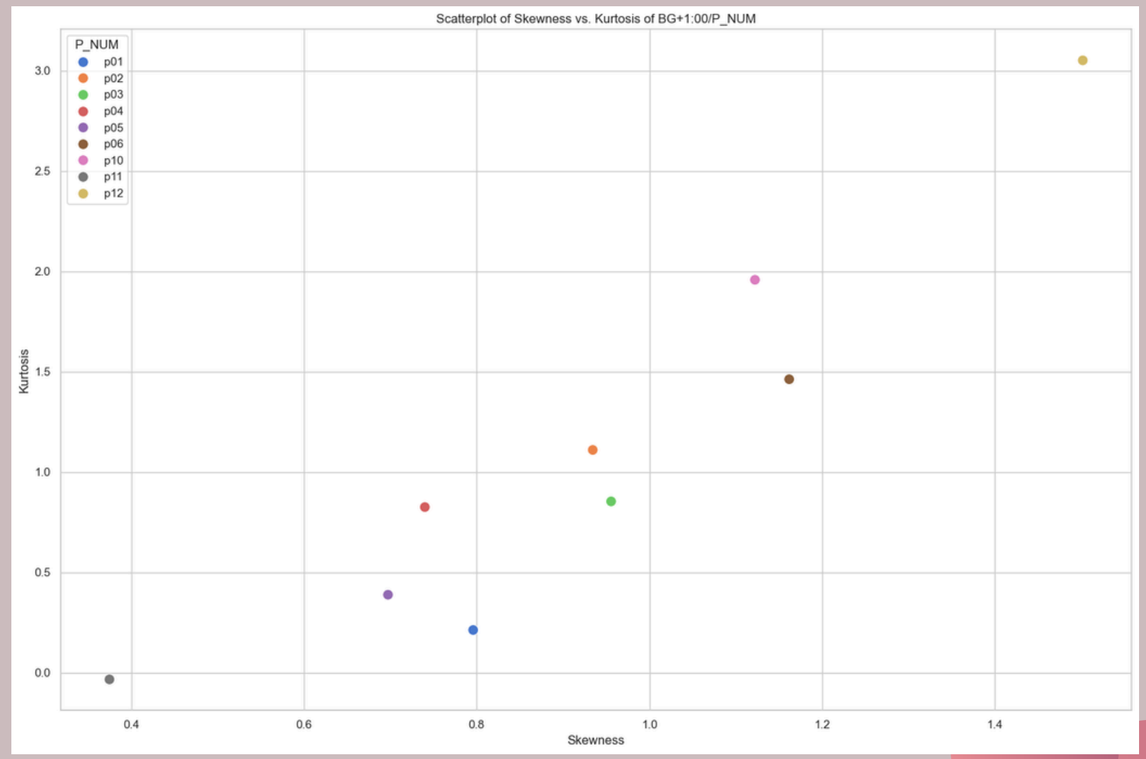
- For data processing, we filled the feature columns with linear interpolation, zero values and participant-specific means (specifically for heart rate)
- To increase generalization and robustness, Gaussian noise was added to all numeric features
- Feature Scaling was done to ensure faster convergence and better model performance
- Some descriptive statistics & exploratory analysis was also done
- Further, the dataset was split into train, validation and test sets

VISUALISATION

Boxplot



Skewness vs Kurtosis Scatterplot



MODELS

- **We experimented with 3 models: Long Short-Term Memory (LSTM), Temporal Convolutional Networks (TCN) and Transformer**

- **The training step involved training for 100 epochs, with the primary loss function being Mean Squared Error (MSE), and Adam optimiser**

- **Early stopping with a patience of 10 epochs was implemented, along with targeted hyperparameter tuning tailored to the specific characteristics of the model used**

ARCHITECTURE - LSTM

- **2-layer LSTM (hidden size: 64) with dropout (0.25) to capture temporal patterns.**
- **Dense layer with 32 units + ReLU for feature transformation.**
- **Final output layer predicts blood glucose level one hour ahead (bg+1:00).**

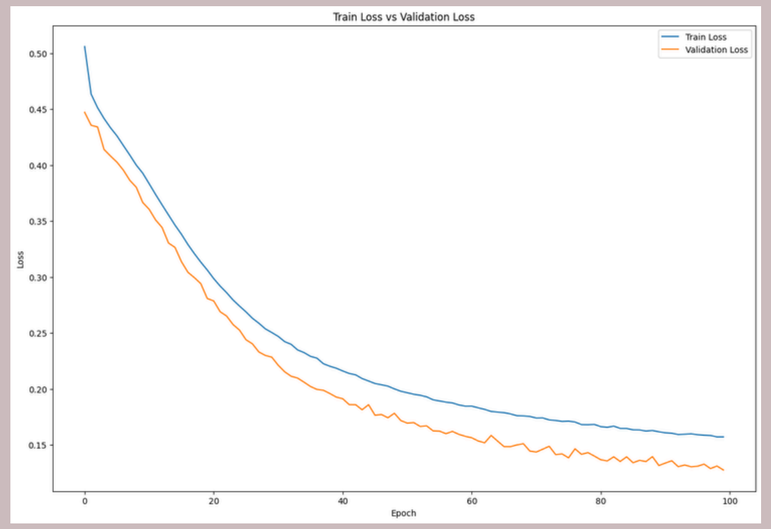
ARCHITECTURE - TRANSFORMER

- **Input Projection: Maps 24×6 input to 64-dim embeddings.**
- **Positional Encoding: Adds temporal order using sine/cosine functions.**
- **2 Transformer Encoders: Each with 8-head self-attention, feed-forward layers, and dropout (0.25).**
- **Global Pooling: Averages encoder outputs to summarize the sequence.**
- **Output Layer: Predicts blood glucose level (bg+1:00) from the final 64-dim vector.**

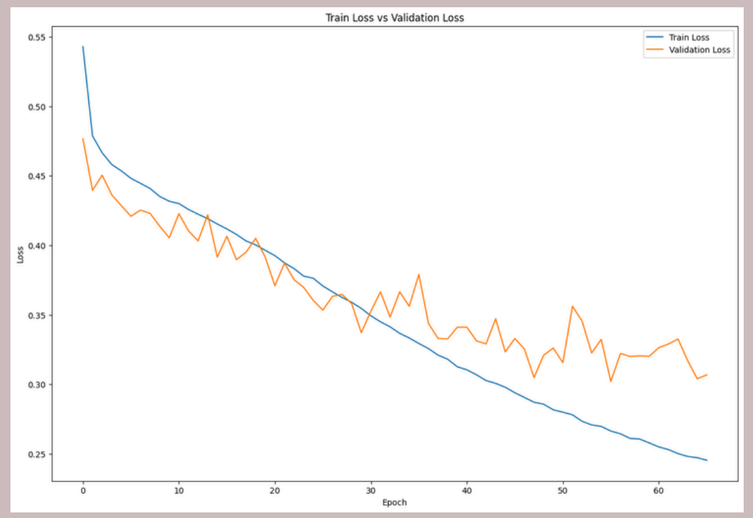
ARCHITECTURE - TCN

- **Input: 24×6 time-series passed into stacked TCN blocks.**
- **Temporal Blocks:**
- **Block 1: 64 filters, no dilation**
- **Block 2: 32 filters, dilation = 2**
- **Each block uses causal convolutions, dropout (0.25), and ReLU.**
- **Residual Connections: Ensure stable training via 1×1 conv projections.**
- **Aggregation: Learns temporal patterns through dilated convolutions.**
- **Output Layer: Final linear layer predicts blood glucose (bg+1:00).**

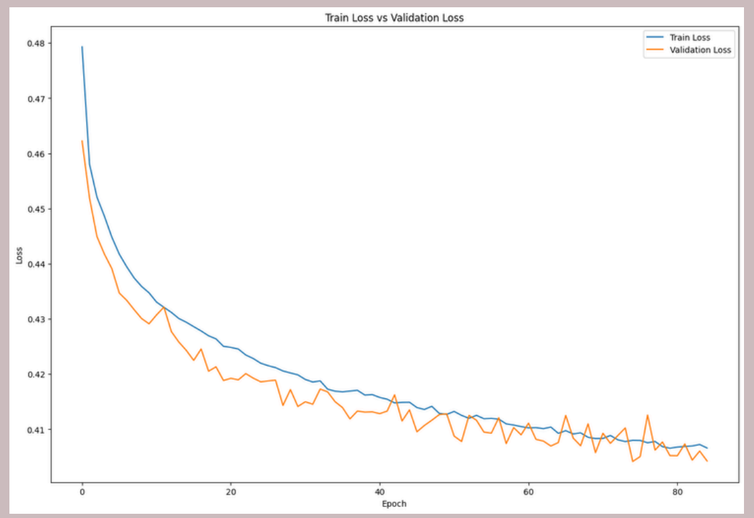
LOSS CURVES



LSTM



Transformer



TCN

PERFORMANCE

Test RMSE: 1.0638
Test MSE: 1.1316
Test MAE: 0.7941
Test MARD: 0.1074
Test MBE: -0.0225
Test R^2: 0.8725
Test Explained Variance: 0.8726
Test MAPE: 10.74%
Test CCC: 0.9291

01 LSTM

Test RMSE: 1.6569
Test MSE: 2.7453
Test MAE: 1.2314
Test MARD: 0.1559
Test MBE: -0.3141
Test R^2: 0.6908
Test Explained Variance: 0.7019
Test MAPE: 15.59%
Test CCC: 0.8604

02 Transformer

Test RMSE: 1.9100
Test MSE: 3.6482
Test MAE: 1.4088
Test MARD: 0.1874
Test MBE: -0.0000
Test R^2: 0.5891
Test Explained Variance: 0.5891
Test MAPE: 18.74%
Test CCC: 0.7414

03 TCN

KAGGLE SCORES

01 LSTM

3.0065

02 Transformer

3.3093

03 TCN

2.5594


Glucose Prediction
Select a Model
Built with Streamlit
Fullscreen

DEMO

THANK YOU