

Modelling and Prediction of Athletic Readiness based on Sleep and Recovery Patterns

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Team: Panchtron

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A. Progress Summary

1) Work Completed:

- **Data Preprocessing & Imputation:** Applied multiple imputation techniques, including Mean, Median, Mode, KNN, Polynomial Interpolation, MICE, and Expectation Maximization (EM). Selected the most effective approach based on data consistency.
- **Feature Engineering & Selection:** Analyzed correlations between Sleep Score, Recovery Metrics (HRV, RHR), and RSI (Readiness Score). Extracted key features for model training.
- **Model Development & Evaluation:** Implemented Ridge Regression, Lasso, Random Forest, LightGBM, and XGBoost. **Ridge Regression performed best**, followed by LightGBM, based on MAE, RMSE, and R^2 Score.
- **Presentation & Documentation:** Delivered a mid-semester presentation summarizing dataset insights, model results, and future steps.

2) Milestones achieved:

- Successfully handled missing data with various imputation techniques and finalized the best approach.
- Built and evaluated predictive models, with Ridge Regression emerging as the best performer.
- Documented findings and provided structured progress updates.

B. Challenges & Resolutions

1) Problems faced:

- **Severe Data Imbalance:** RSI values were sparse, affecting predictions. Addressed through feature engineering and resampling techniques.
- **Variability in Imputation Results:** Different methods led to varied model performances. Resolved by comparing models trained on different imputed datasets.
- **Model Performance Differences:** Ridge Regression outperformed complex models like XGBoost. Focus shifted to optimizing Ridge and LightGBM.

C. Upcoming Tasks

1) Tasks Planned:

- Fine-tuning hyperparameters for Ridge Regression and LightGBM.
- Exploring deep learning models for comparison.
- Implementing dataset augmentation techniques to improve imputation effectiveness.
- Enhancing feature selection through further analysis.