# Identifying Atrial Fibrillation with Stepping Windows

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# Database Overview

- Publicly available dataset by MIT and BIH
- 23 ECG samples - patients with atrial fibrillation
  - Each recording is 10 hours long

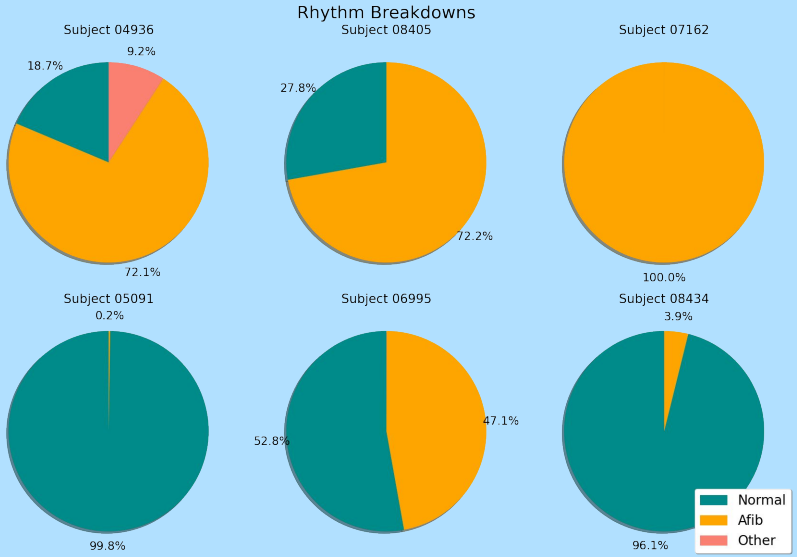


Figure 1: Rhythm distributions

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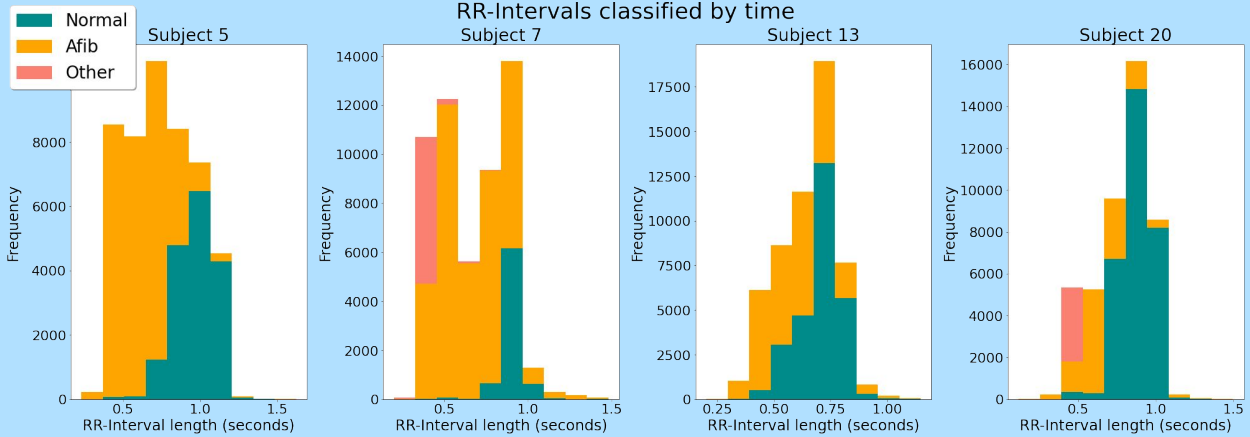
# RR–Intervals

- Time between two successive R-peaks in an ECG recording
- Outlier removal
  - Greater than 500 samples (lower than 30 bpm)
- n = 750,320

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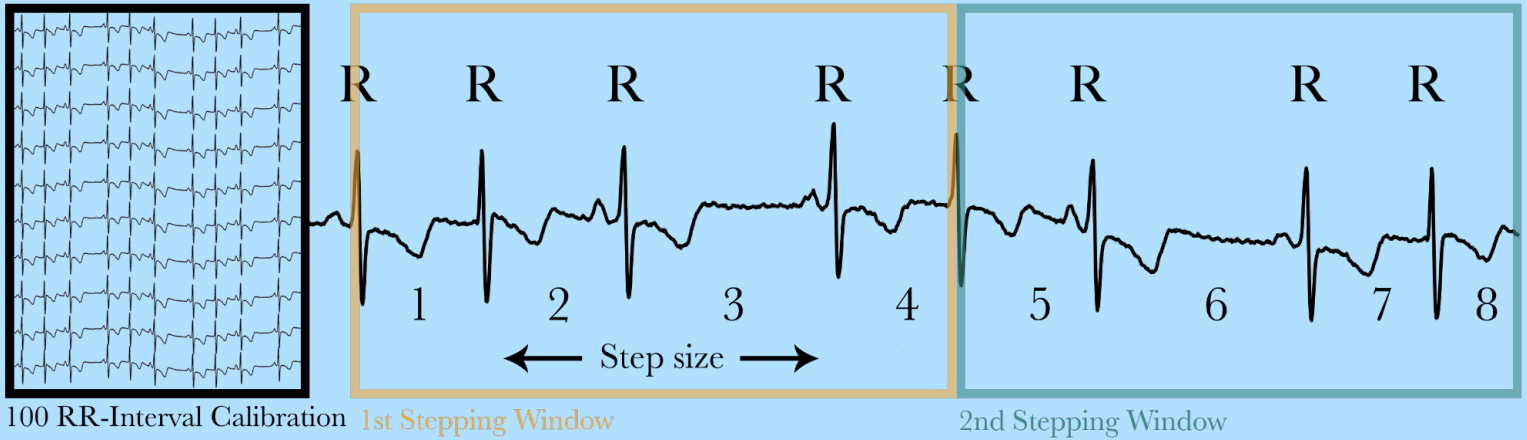
# Stepping Window

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- 4 RR-Intervals
- Cumulative
- No overlap in the windows
- Data collected from the previous window is weighted

# Classification Models

**Non-Tree Based Models**

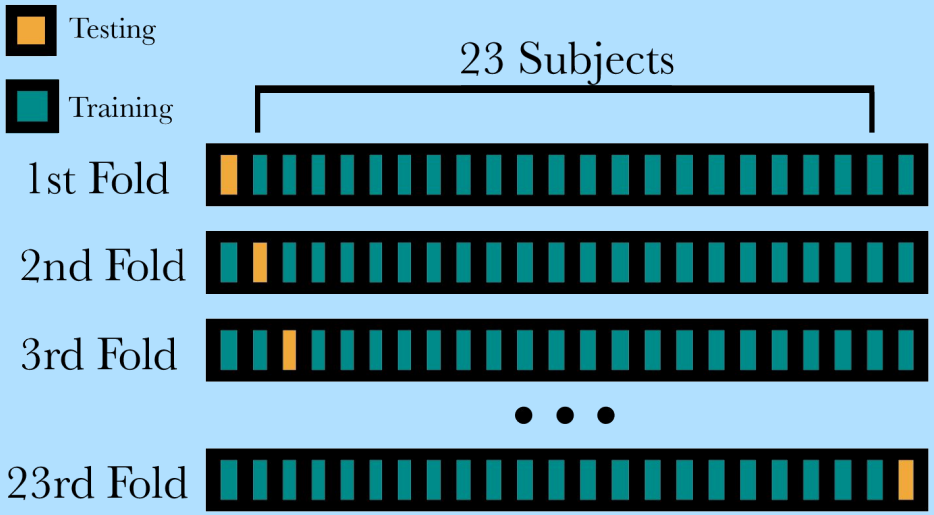
- Logistic Regression
- Linear Discriminant Analysis (LDA)
- Quadratic Discriminant Analysis (QDA)
- K-Nearest Neighbors (KNN)
- Support Vector Classifier (SVC)

**Tree Based Models**

- Decision Tree
- Random Forest
- Boosting
  - AdaBoost
  - XGBoost
  - LightGBM
  - CatBoost

# Cross Validation

- Leave-One-Person-Out (LOPO)
  - 22 subjects training
  - 1 subject for testing
- 23 folds

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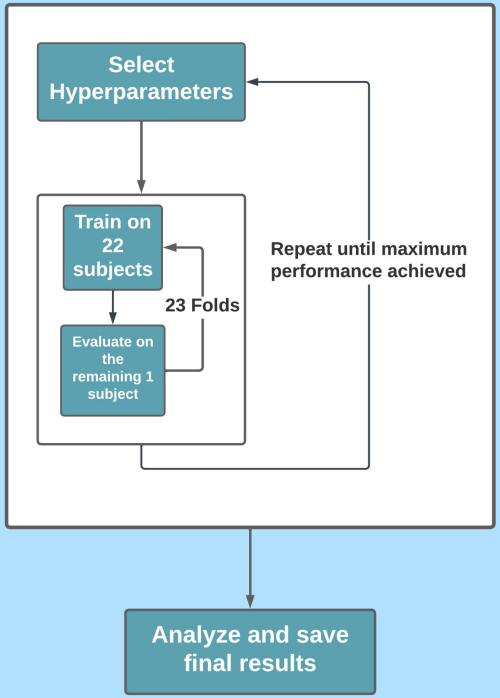
# Features

- **Transition Proportions**
- Coefficient of Variance
- Interquartile Range (IQR)
- Median Absolute Deviation (MAD)
- Root Mean Square of Successive Differences
- Range
- Standard Deviation
- RR-Variance
- R-Mean Variance

# Evaluation Process



# Model Performance

| Classifier | Avg Accuracy | Std Accuracy | Sensitivity | Specificity | Precision |
|---|---|---|---|---|---|
| LogReg | 88.73% | 11.50% | 89.16% | 89.19% | 82.61% |
| LDA | 88.64% | 11.79% | 90.03% | 86.85% | 81.70% |
| QDA | 73.69% | 22.13% | 88.78% | 42.14% | 65.56% |
| KNN (k=9) | 87.70% | 11.89% | 83.95% | 92.56% | 84.84% |
| Decision Tree | 90.44% | 8.35% | 90.55% | 85.06% | 80.85% |
| Random Forest | 93.64% | 7.17% | 91.93% | 89.45% | 87.17% |
| AdaBoost | 92.75% | 8.73% | 90.58% | 92.32% | 86.85% |
| SVC | 87.23% | 13.36% | 86.88% | 88.48% | 82.75% |
| XGBoost | 94.63% | 6.49% | 92.64% | 89.96% | 87.94% |
| CatBoost | 94.51% | 6.59% | 92.46% | 89.97% | 87.88% |
| LightGBM | 94.48% | 6.75% | 92.60% | 89.94% | 87.70% |

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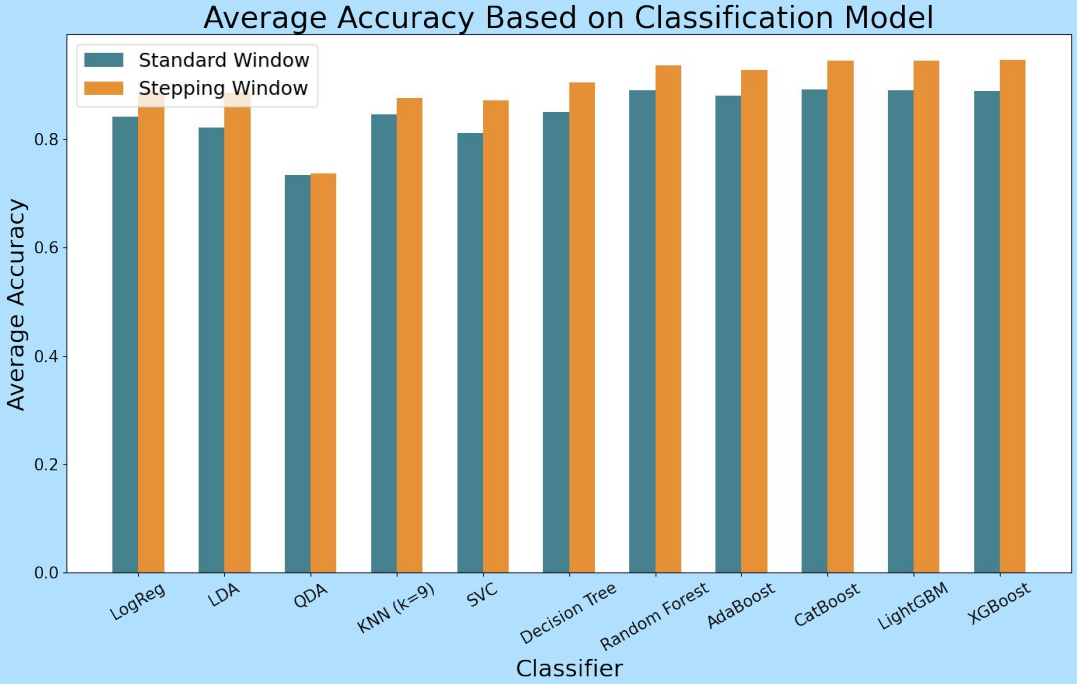
# Model Performance

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# References

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