

Weekly NFL Fantasy Football Point Forecasting Using Gradient Boosting Models

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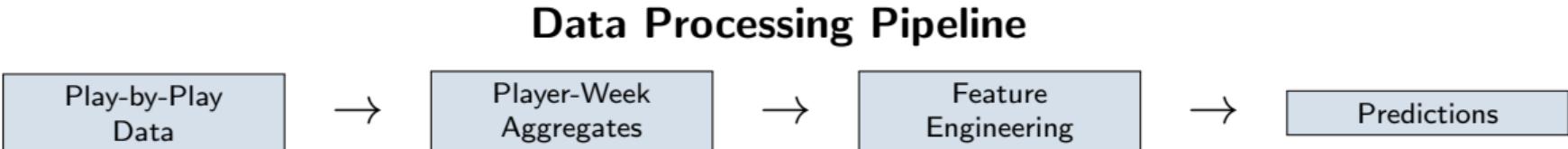
Stevens Institute of Technology
AAI 595 Applied Machine Learning

Predicting weekly fantasy points using machine learning
on NFL play-by-play data (2009–2016)

Why Weekly Fantasy Forecasting Is Hard

- ▶ **High week-to-week variance:** Individual game outcomes are noisy and unpredictable
- ▶ **Context-dependent performance:** Opponent matchups, injuries, weather, and game script matter
- ▶ **Limited historical data:** Only 16–17 games per season per player
 - ⇒ Need time-aware ML models, not just season-long averages

Data & Pipeline Overview



- ▶ **Seasons:** 2009–2016 (8 years)
- ▶ **Player-weeks:** ~40,000 observations
- ▶ **Features:** 51 time-aware features (lag, rolling, season-to-date)
- ▶ **Scoring:** Half-PPR computed directly from play-by-play

Methodology: Features, Split, Baselines

Feature Types:

- ▶ Lag variables (previous week)
- ▶ Rolling averages (3, 5, 8 weeks)
- ▶ Season-to-date aggregates
- ▶ Trend indicators
- ▶ Usage metrics

Strict historical-only:

No current-week leakage

Time-Based Split:

Train: 2009–2014

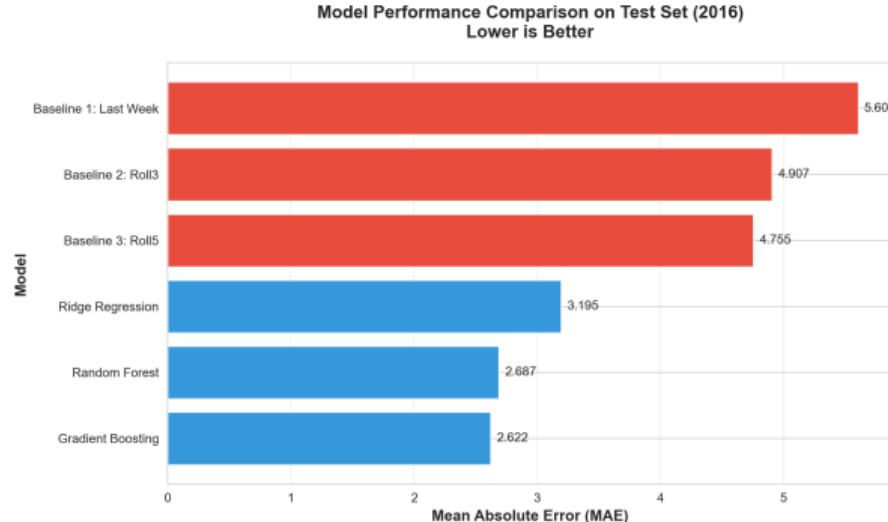
Val: 2015

Test: 2016

Baselines:

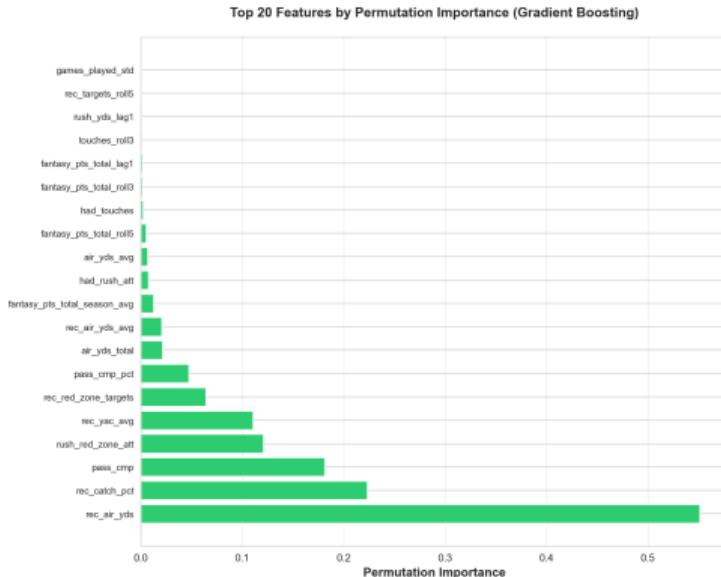
- ▶ Last week
- ▶ 3-week rolling avg
- ▶ 5-week rolling avg

Results: Model Comparison



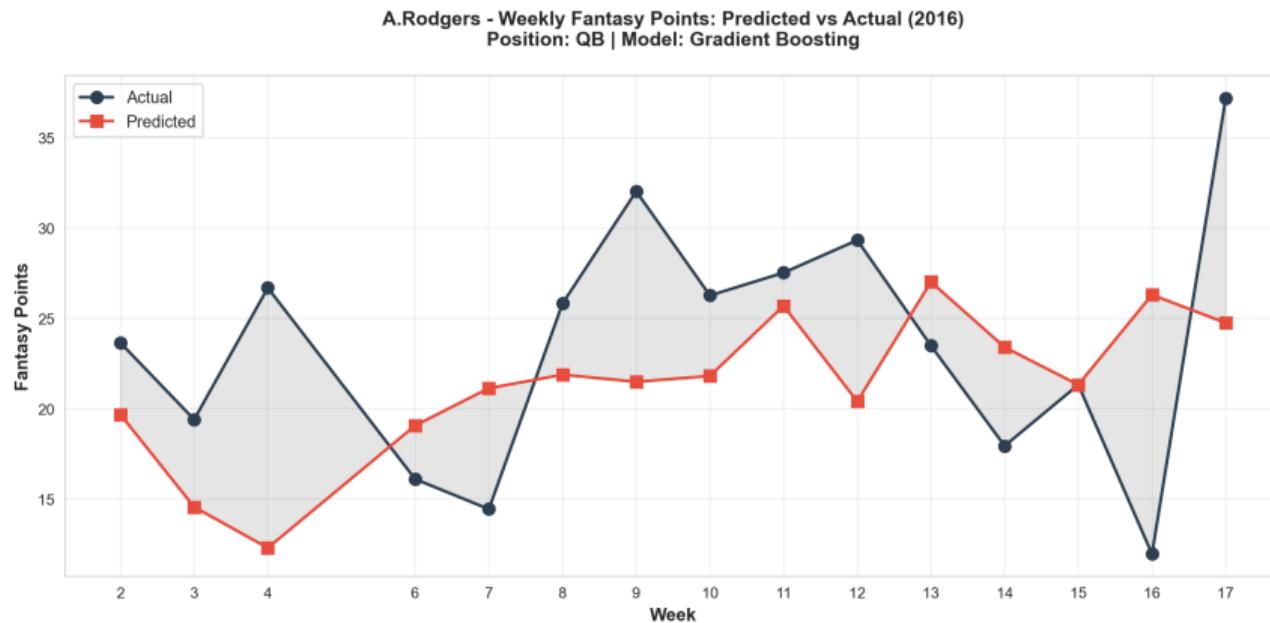
- ▶ **Best Model:** Histogram Gradient Boosting
- ▶ **Test MAE:** 2.62 fantasy points
- ▶ **Improvement:** 45% better than best baseline (5-week rolling: 4.76)

What the Model Learned: Feature Importance



Key insight: Recent form (rolling averages) dominates—sustained trends beat single-week spikes

Player-Level Example: Aaron Rodgers (2016)



Model tracks trends well but struggles with extreme outliers

Limitations & Future Work

What this system is good for:

- ▶ Weekly lineup decisions based on recent trends
- ▶ Outperforming naive heuristics in realistic forecasting scenarios

Limitations & Next Steps:

- ▶ Does not capture contextual factors (opponent strength, injuries, weather)
- ▶ Missing Week 1 data limits early-season predictions
- ▶ Future: Incorporate matchup features, ensemble predictions, multi-step forecasting