



JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING



Team MoBI

Taiming Chen, Liora Dsilva, Sai Pranav Avva, Isha Dev, Deborah Roman
Heilmeier Catechism

What are we trying to do?

- Reduce the number of data streams for a complete MoBI (Mobile Brain/Body Imaging) experiment
- Find a relationship between MOBI data and behavior error

How is it done today? What are the limits?

- Running complete experiment
 - Time consuming and expensive
- Model limitations
 - High prediction error
 - Ridge regression

What's new in our approach?

- Comparing ridge regression with nonlinear regression models
- Characterize feature importance
- Implement time as a feature in the ML model for this dataset

Why will it be successful?

- Preliminary testing has shown positive and reproducible predictions
- Feature importance will identify crucial data streams

Who cares? What difference will it make?

- A simplified diagnostic tool for the 17.4% of the children affected by mental, behavioral and developmental disorders (CDC)
- Increase in model accuracy by 20%
- Reduction in input data requirement by 25%
- Deeper insights that help improve personalized interventions
- Healthcare professionals, wearable technology manufacturers, etc.

Risks, Cost and Duration

Risks

- Limited test subjects ($n = 56$)
- Type I and Type II error

Cost

- 5 students
- Time and effort

Duration

- 9 months

Mid-term and Final Exams

Fall Semester

Sprint 0 (Sept 12th – 19th)

- Submit Heilmeier Catechism document
- Replicate ridge regression results across all team members' systems

Sprint 1 (Sept 20th – Oct 11th)

- Replicate nonlinear algorithms (SPORF and MORF)

Sprint 2 (Oct 12th – Dec 7th)

- Apply feature importance algorithms for feature selection
- Improve prediction score with larger datasets ($R_{\text{squared}} > 0.5$)

Mid-term and Final Exams

Spring Semester

Sprint 3 (Dec 8th – March 5th)

- Improve accuracy by including time by 10%
- Draft for the manuscript

Sprint 4 (March 5th to May 5th)

- Submit a manuscript

Questions/Feedback

Team MoBI: Final Results

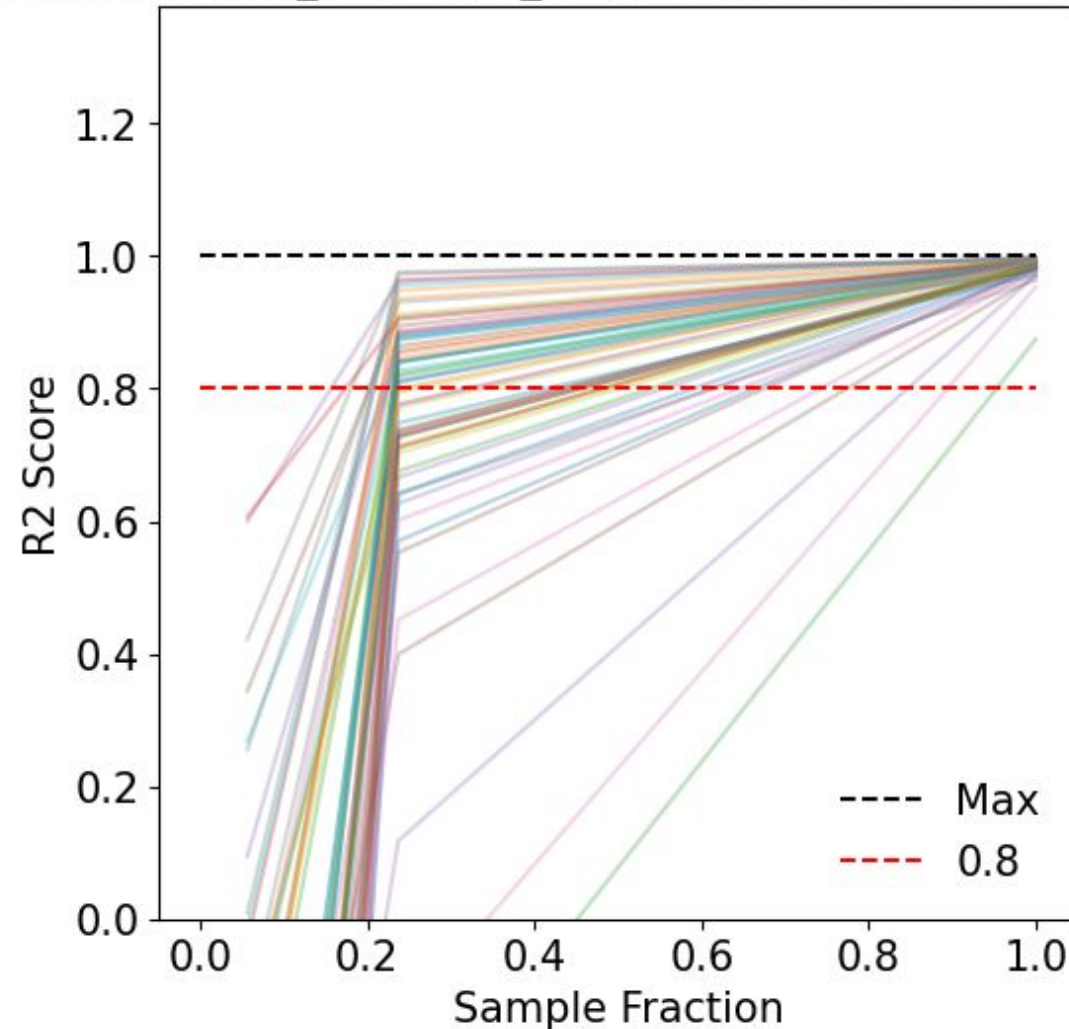
11/19/2024

Team Members: Liora Dsilva, Isha Dev, Taiming Chen,
Deborah Roman, Sai Pranav Avva, Riya Modi

Results - Random Forest Regression

- Target: Position difference
- 5 fold cross validation
- 61 subjects, ~17000 raw data streams

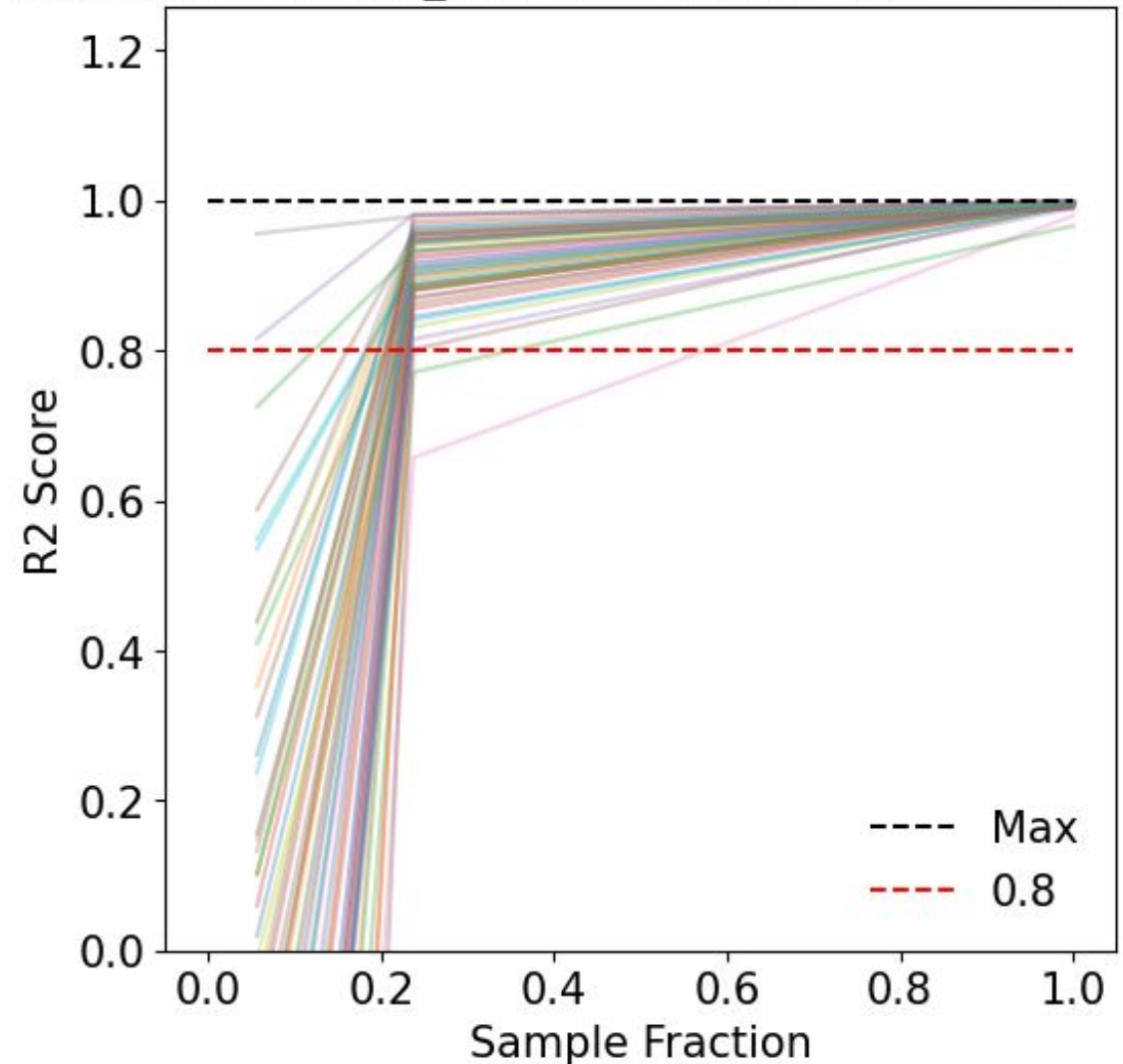
Regression for user_pos - stim_pos: 5-fold means (RS = 23) truncated



Results - Random Forest Regression

- Target: Stimulus position
- 5 fold cross validation
- 61 subjects, ~17000 raw data streams

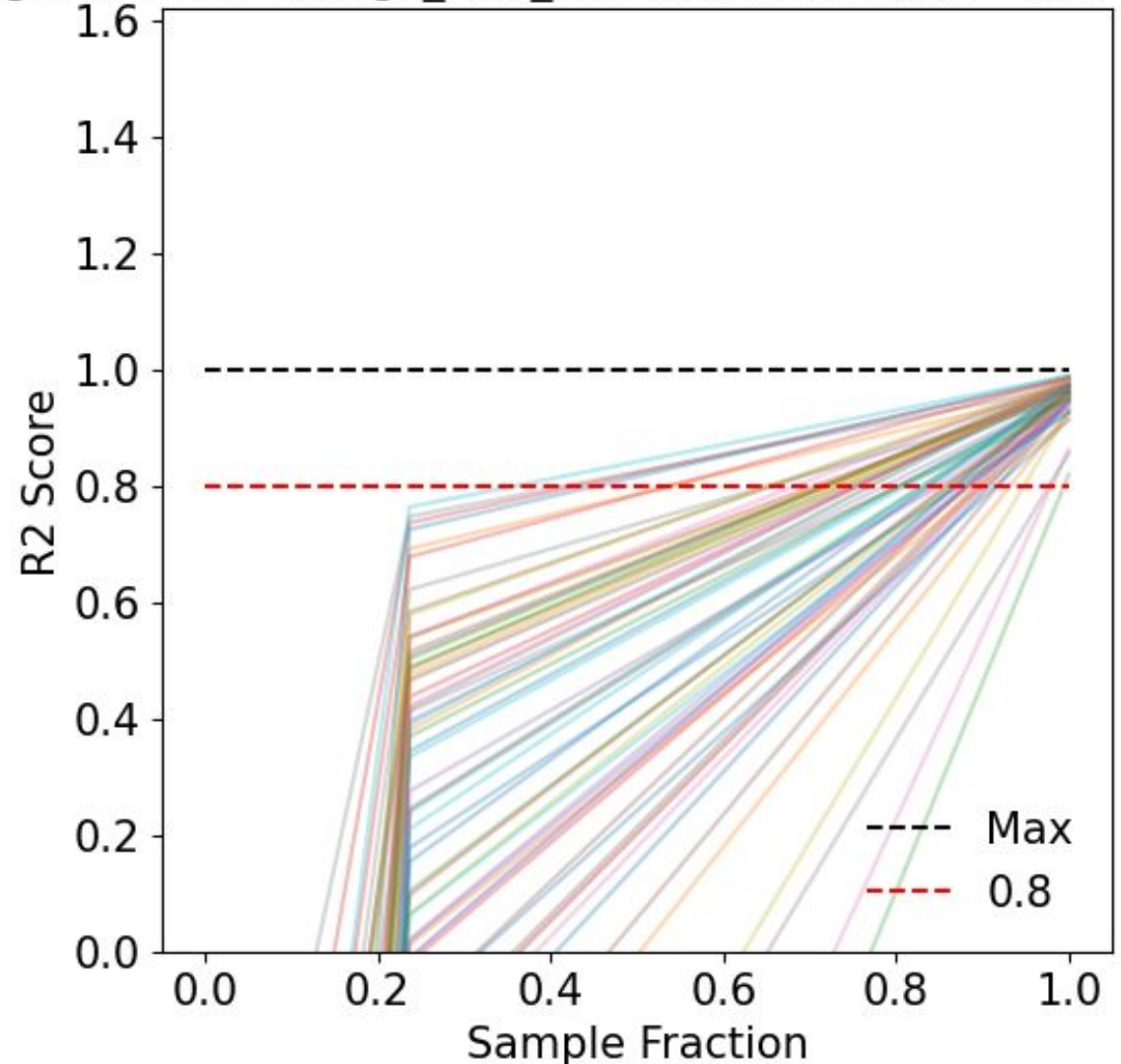
Regression for stim_pos: 5-fold means (RS = 23) truncated



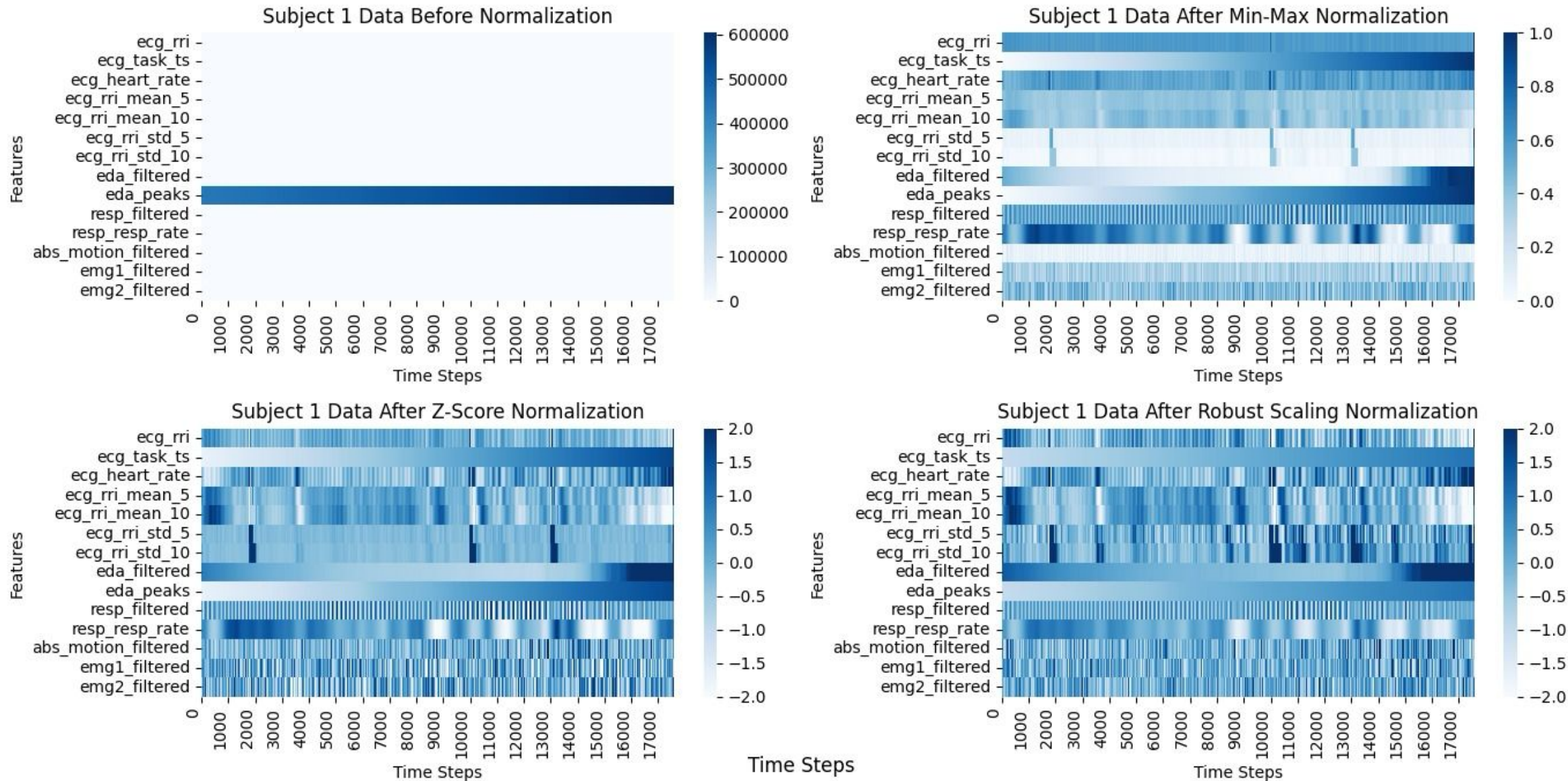
Results - Random Forest Regression

- Target: Stimulus speed
- 5 fold cross validation
- 61 subjects, ~17000 raw data streams

Regression for change_rate_x: 5-fold means (RS = 23) truncated

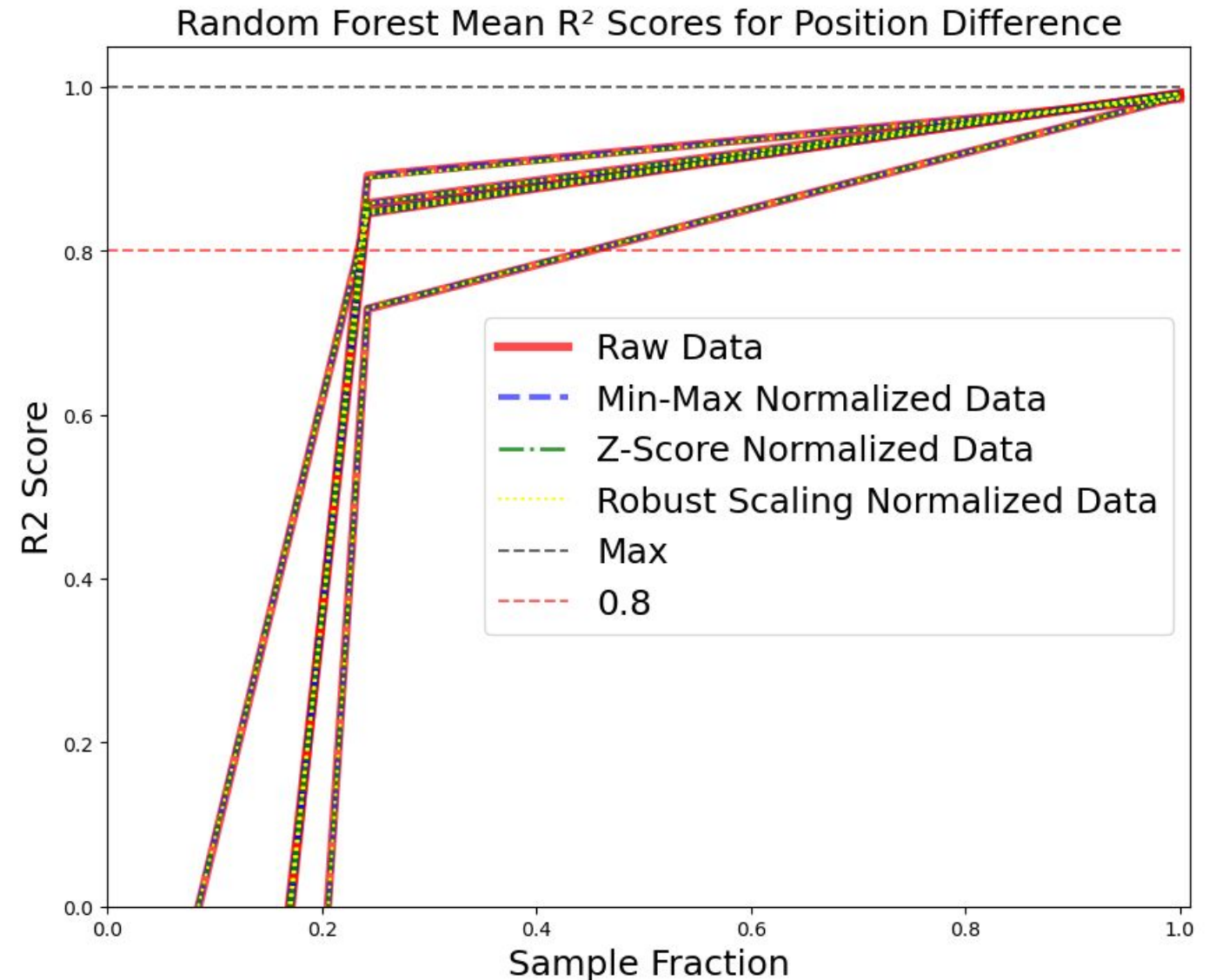


Results - Normalization



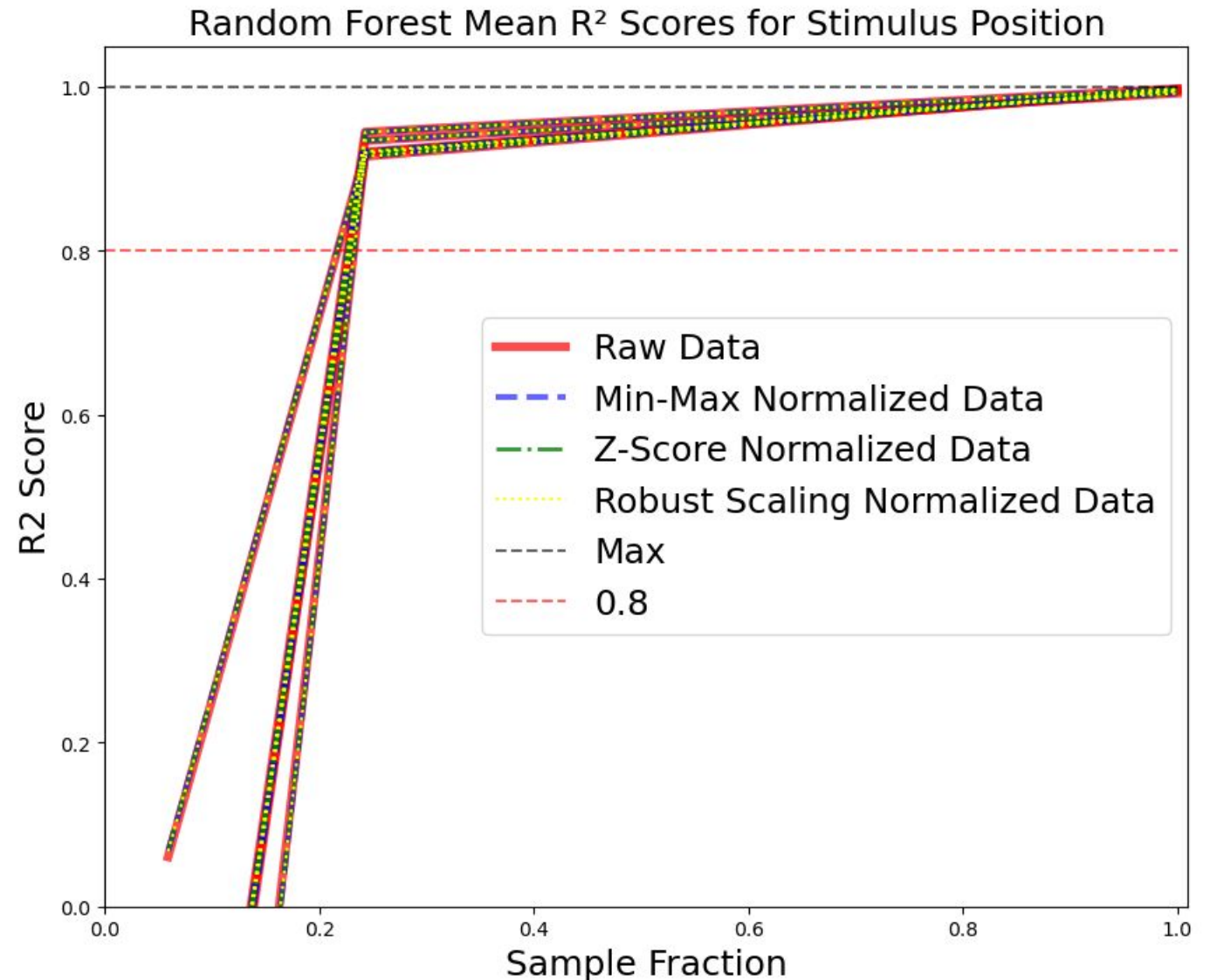
Results - Random Forest Regression

- Target: Position difference
- 5 fold cross validation
- 5 subjects, ~17000 normalized data streams



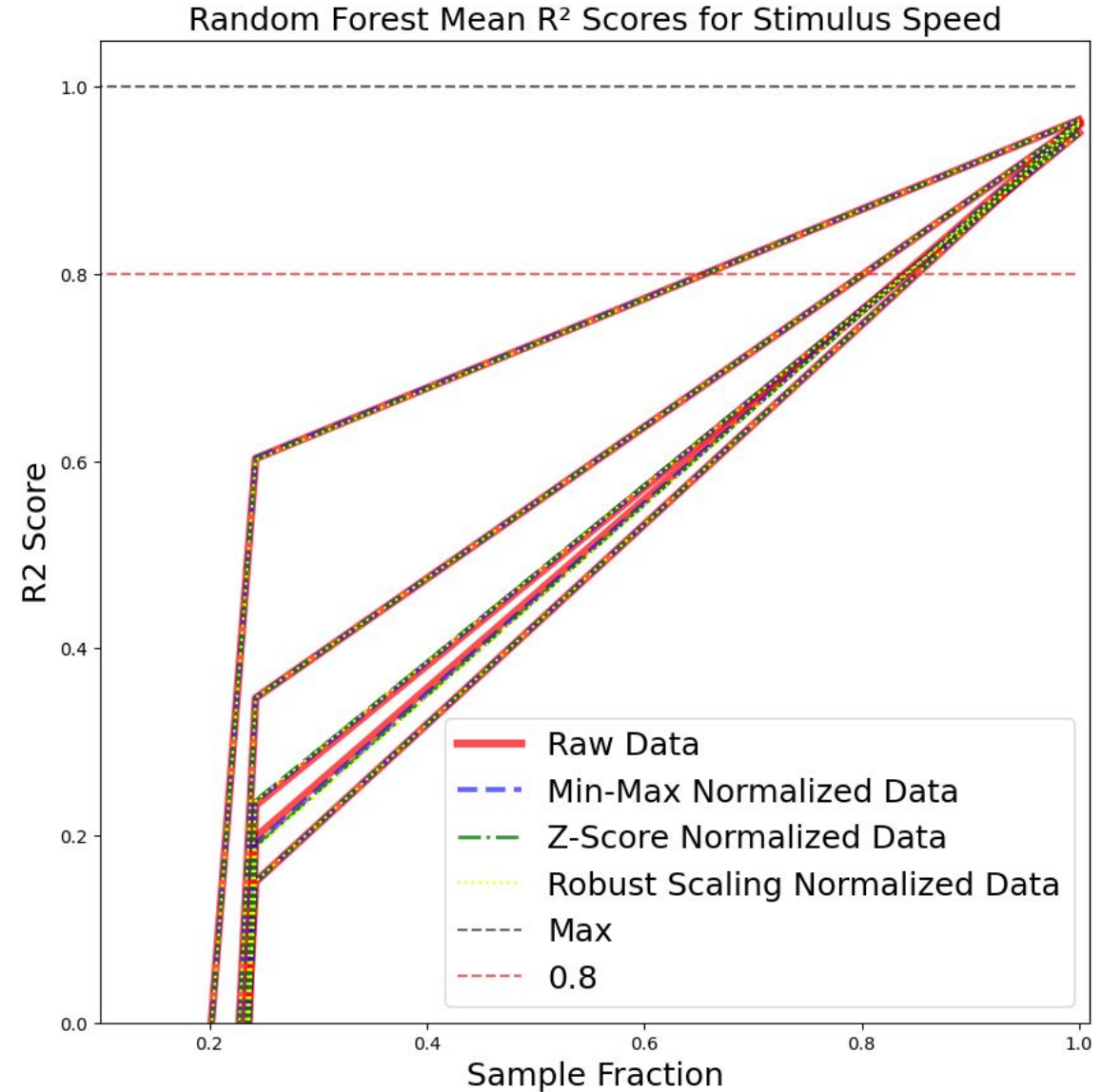
Results - Random Forest Regression

- Target: Stimulus position
- 5 fold cross validation
- 5 subjects, ~17000 normalized data streams



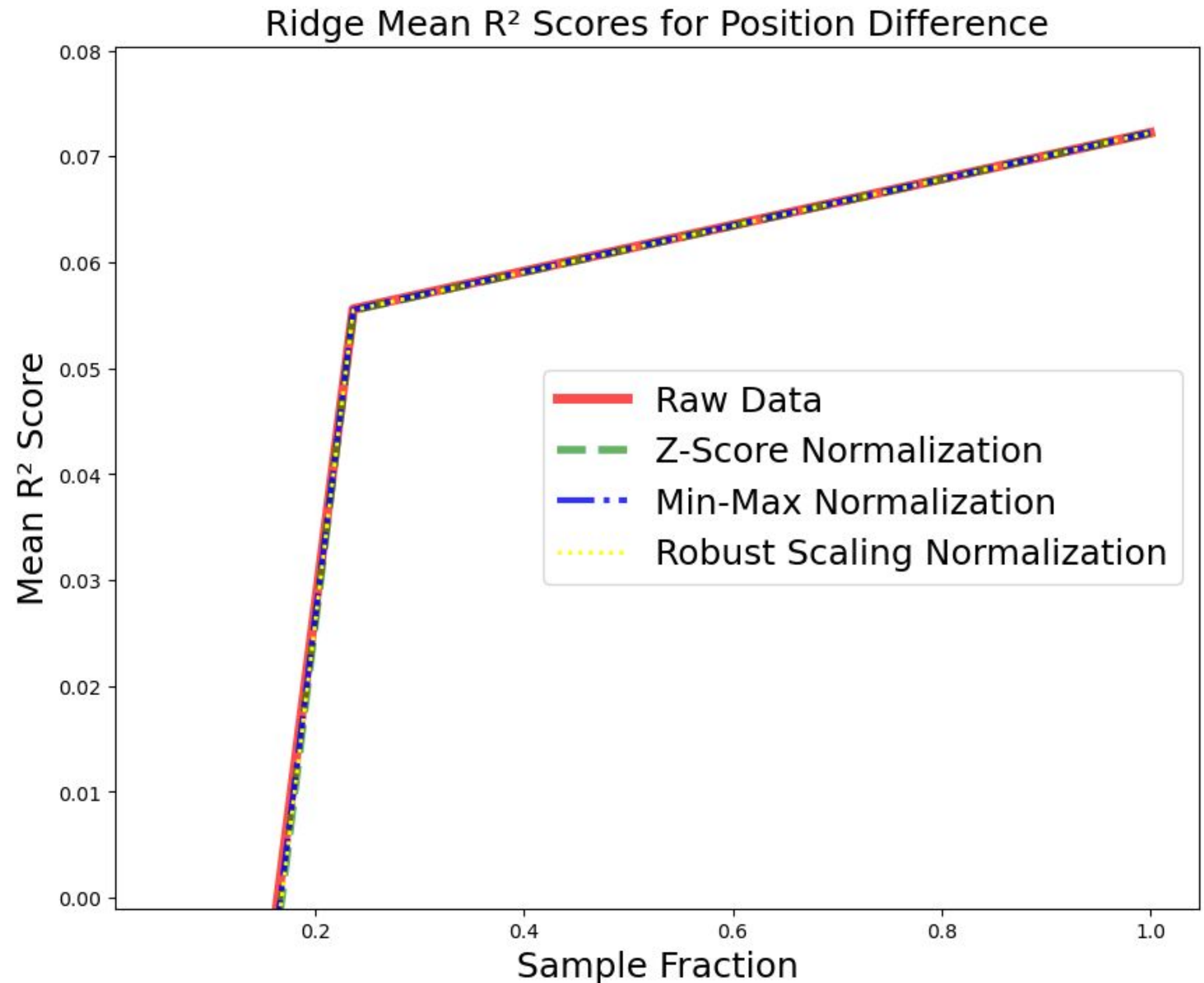
Results - Random Forest Regression

- Target: Stimulus speed
- 5 fold cross validation
- 5 subjects, ~17000 normalized data streams



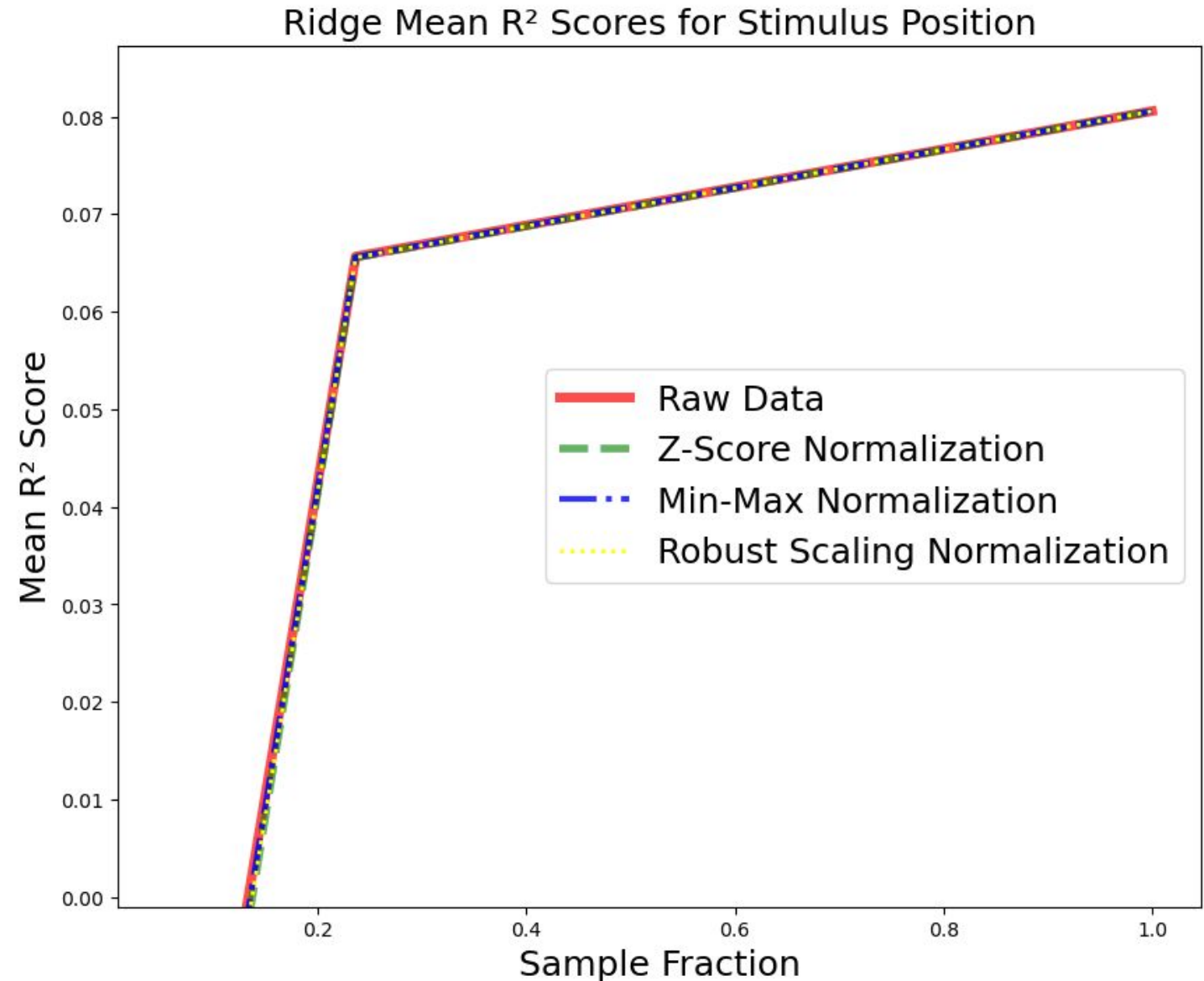
Results - Ridge Regression

- Target: Position difference
- 5 fold cross validation
- 1 subject, ~17000 normalized data streams



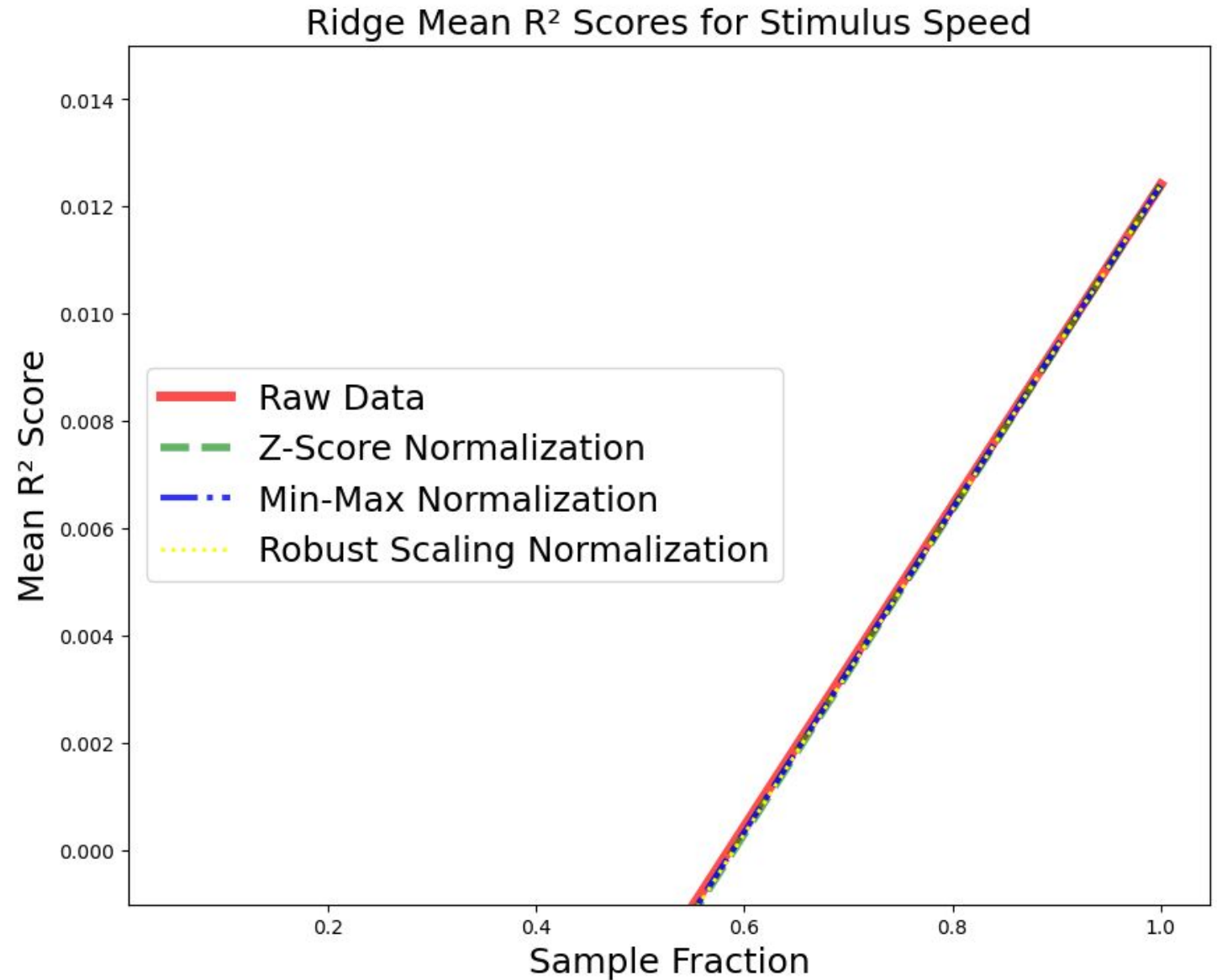
Results - Ridge Regression

- Target: Stimulus position
- 5 fold cross validation
- 1 subject, ~17000 normalized data streams



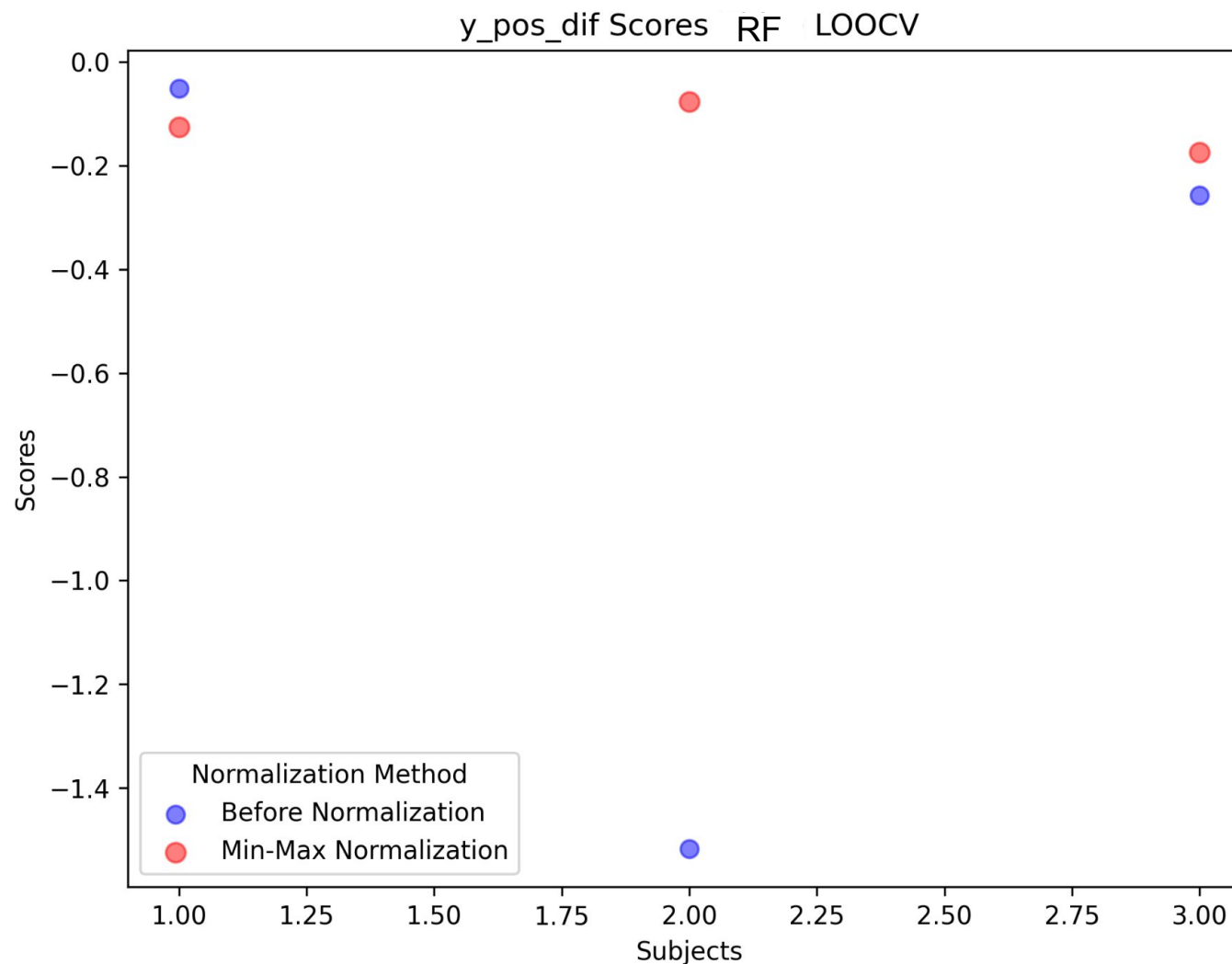
Results - Ridge Regression

- Target: Stimulus speed
- 5 fold cross validation
- 1 subject, ~17000 normalized data streams



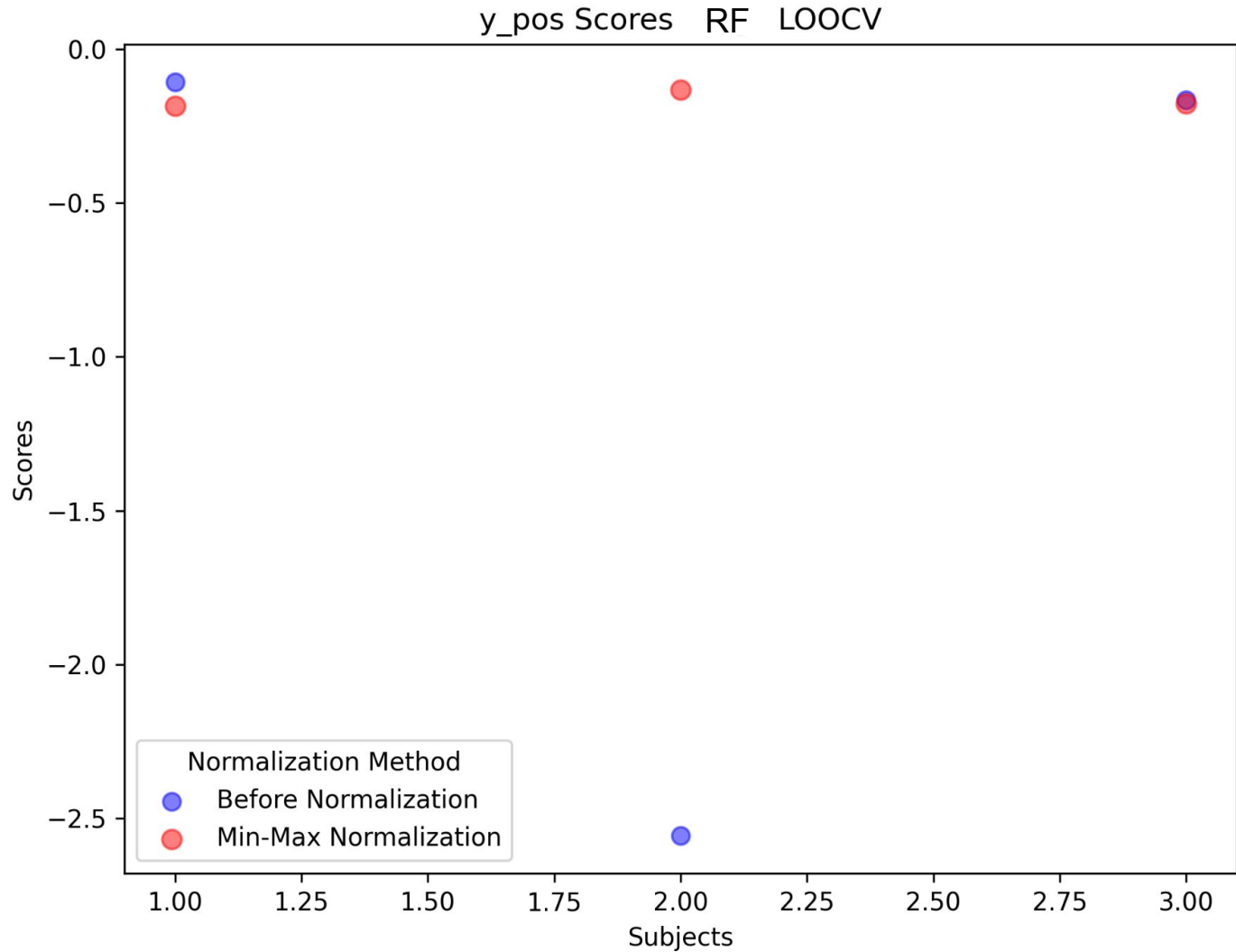
Results - Random Forest Regression

- Target: Position difference
- Leave one out cross validation
- 3 subjects, ~17000 data streams



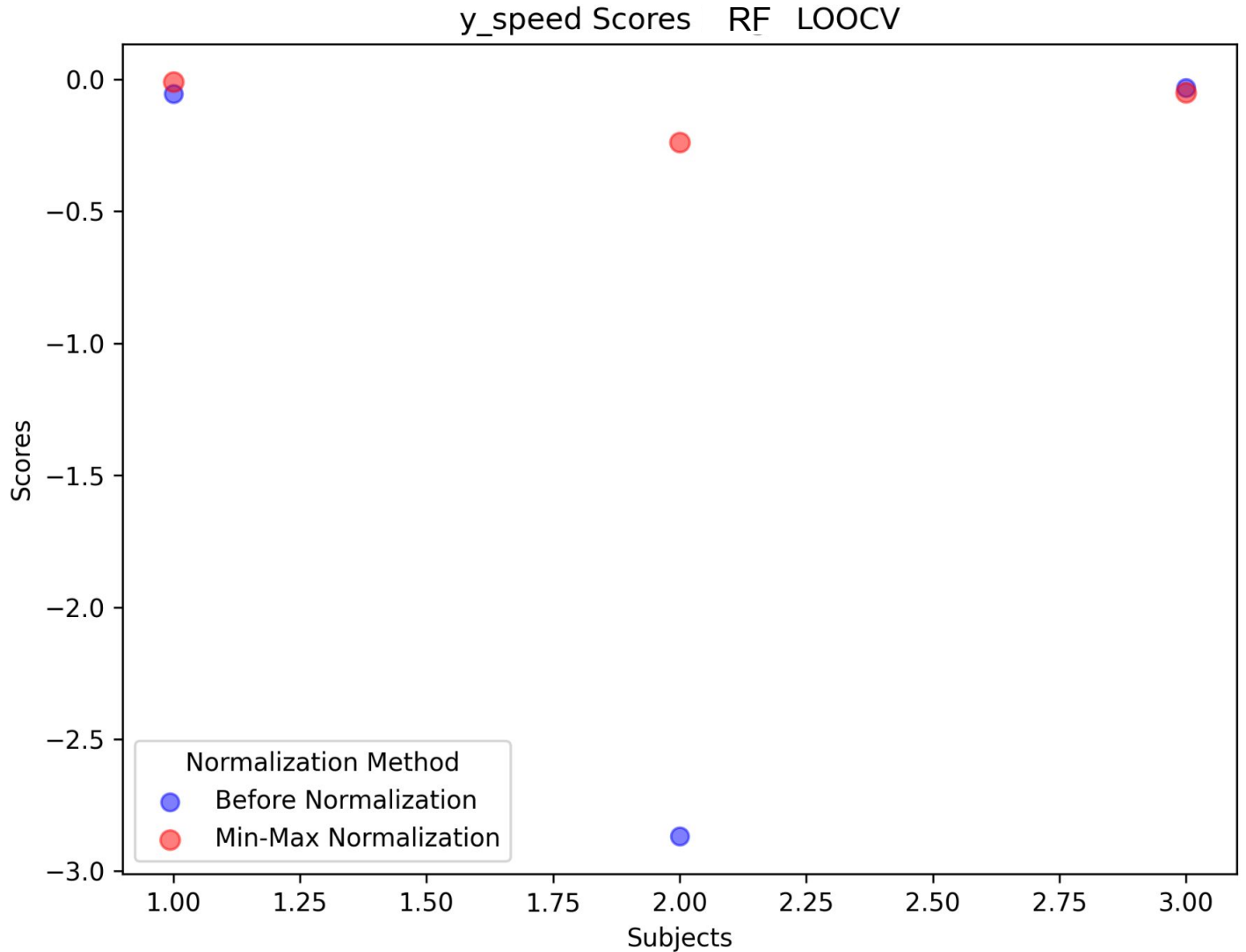
Results - Random Forest Regression

- Target: Stimulus position
- Leave one out cross validation
- 3 subjects, ~17000 data streams



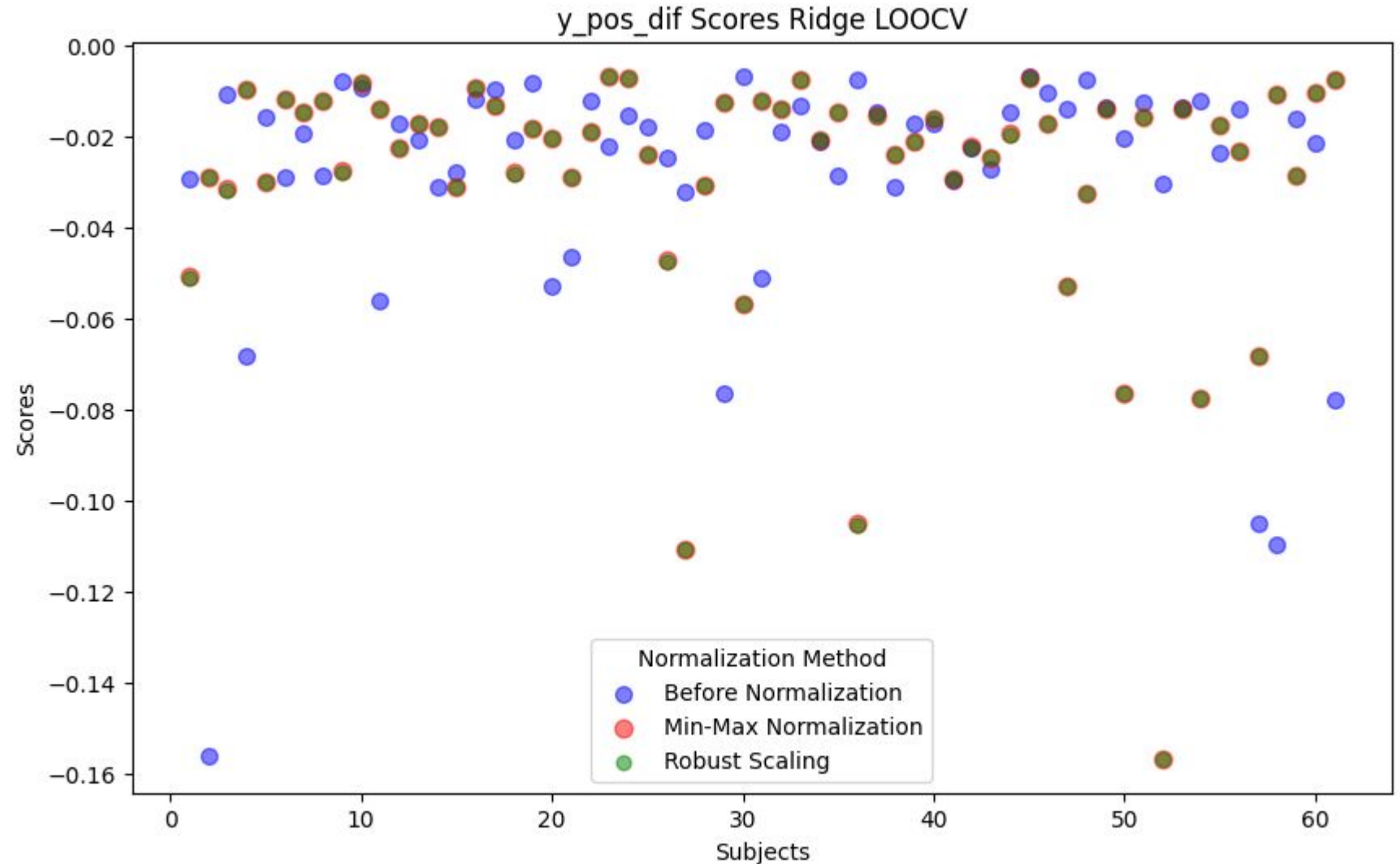
Results - Random Forest Regression

- Target: Stimulus speed
- Leave one out cross validation
- 3 subjects, ~17000 raw data streams



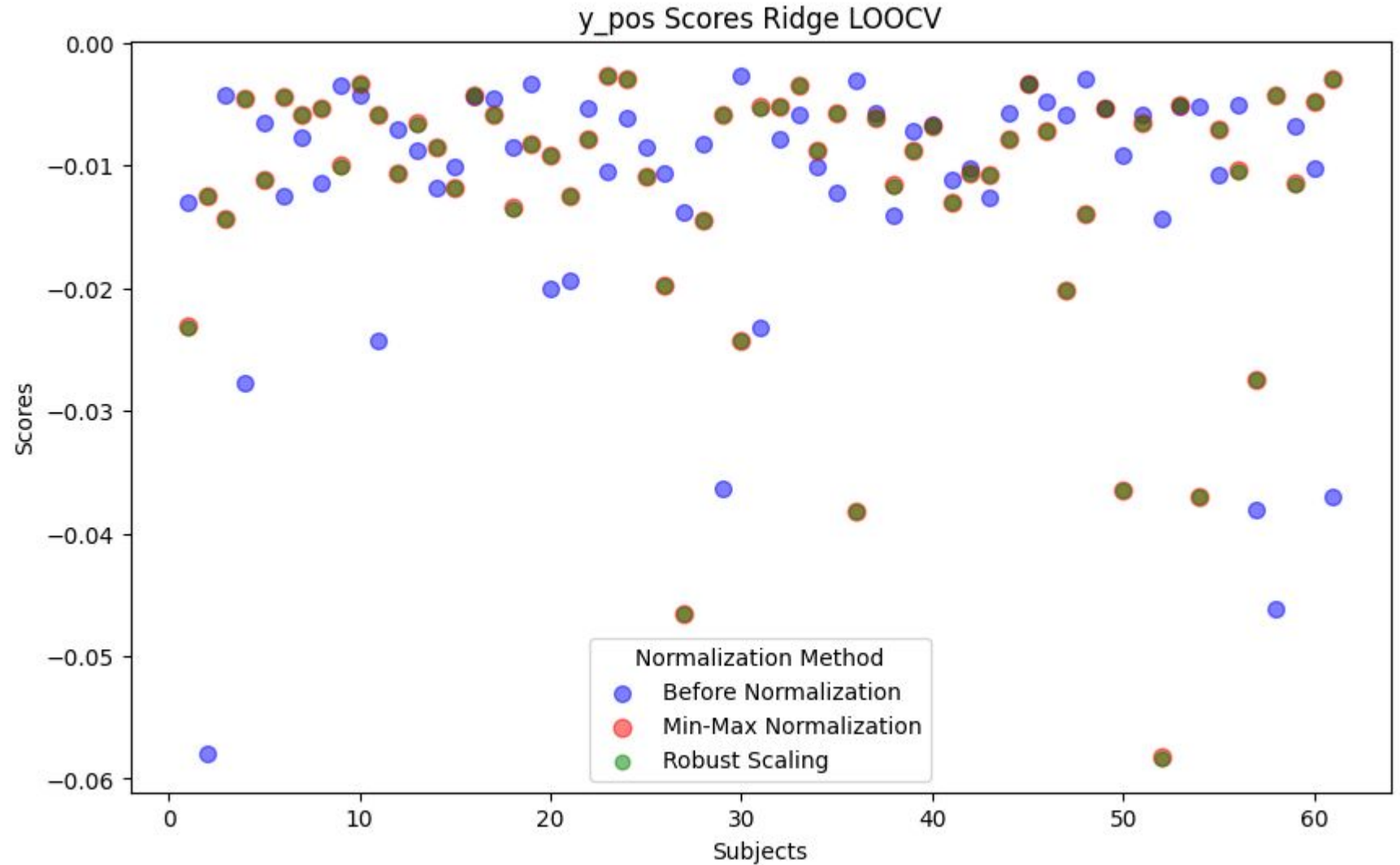
Results - Ridge Regression

- Target: Position Difference
- Leave one out cross validation
- 61 subjects, ~17000 data streams



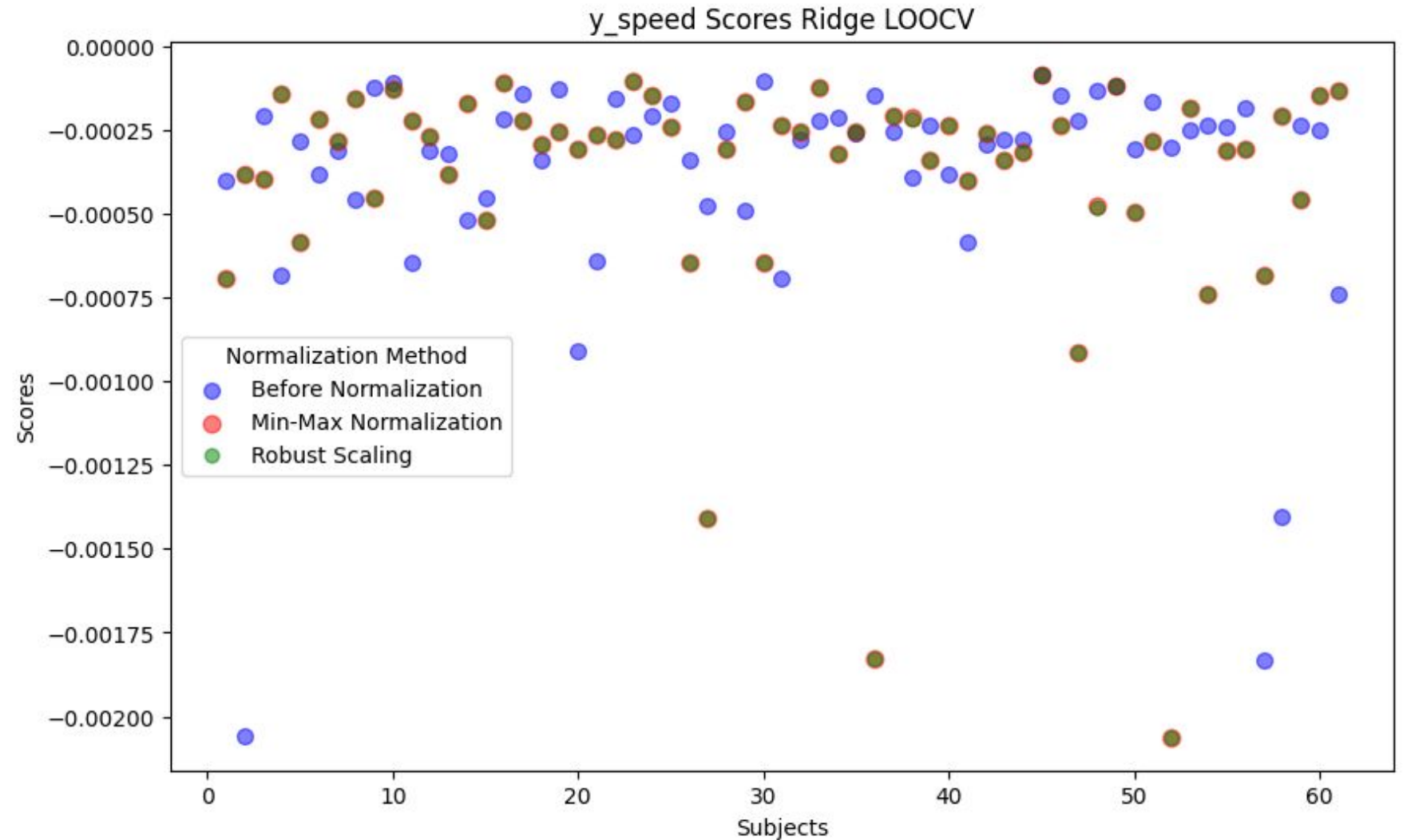
Results - Ridge Regression

- Target: Stimulus Position
- Leave one out cross validation
- 61 subjects, ~17000 data streams

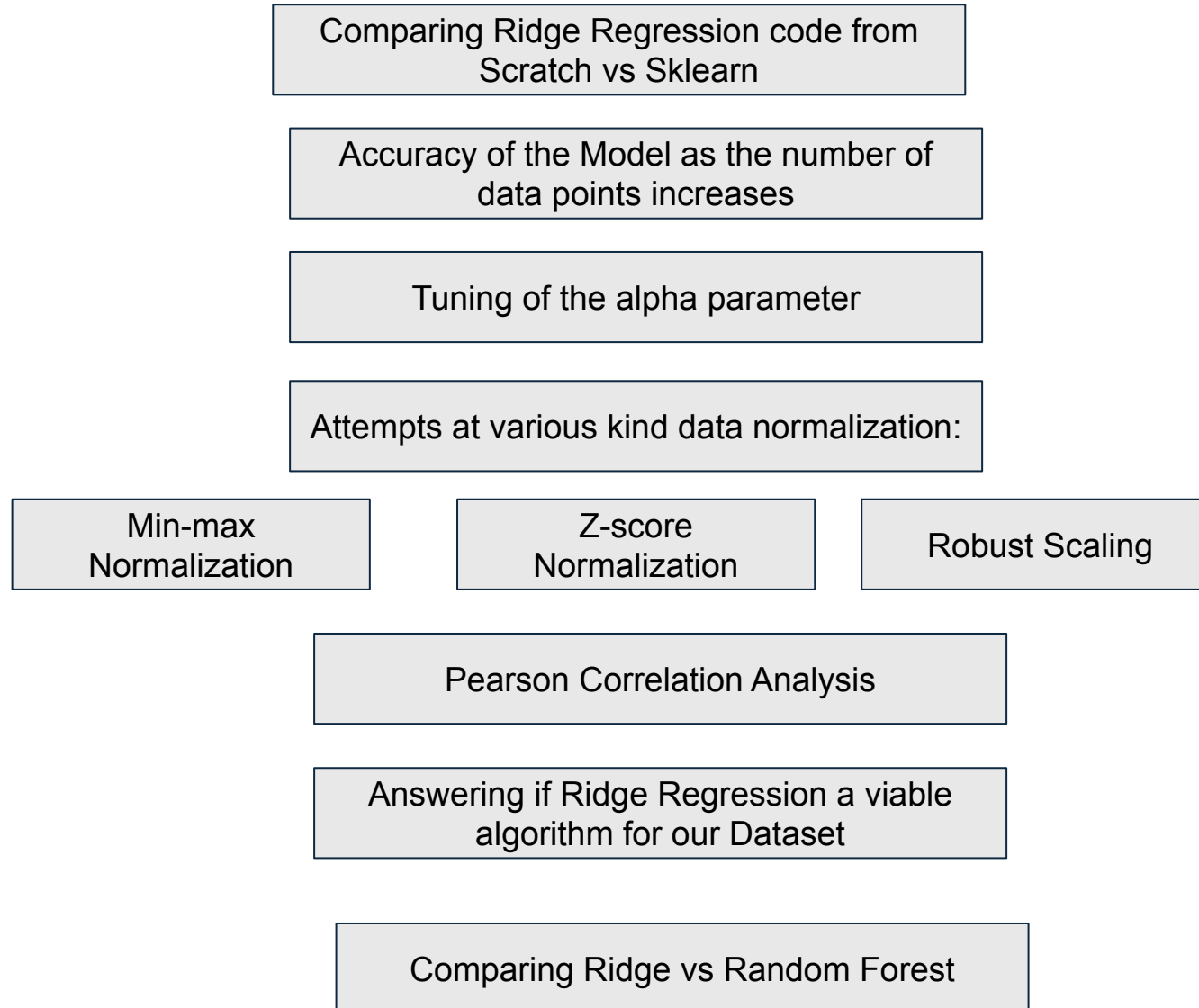


Results - Ridge Regression

- Target: Stimulus Speed
- Leave one out cross validation
- 61 subjects, ~17000 data streams



Final Presentation Slide Layout:



Questions ?