

# Predicting High School Track Times

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Project Luther  
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Given:

- 9<sup>th</sup> grade PR (Personal Record)
- 10<sup>th</sup> grade PR
- 11<sup>th</sup> grade PR

Predict:  
12<sup>th</sup> grade PR

Athletic.net Track & Field

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Patrick Gibson
Track & Field Profile

Claim this Athlete

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All

High School

2013 Outdoor Season

Squalicum HS

12th Grade

800 Meters

2	1:59.1h	Mar 15	Squalicum, Bellingham, and Sehome	V	F
1	2:06.60	Mar 28	Lynden vs Squalicum	V	F
3	1:58.13 PR	Apr 19	NWC Championship Meet	V	F

1600 Meters

1	4:36.24	Mar 28	Lynden vs Squalicum	V	F
1	4:16.2h	Apr 6	Birger Solberg Invitational	V	F
1	4:30.66	May 2	Mt. Baker & Squalicum @ Sehome	V	F
1	4:18.66	May 8	NWC 2A Sub District Meet	V	F
1	4:18.66	May 10	NWC 2A Sub District Meet	V	F
3	4:19.75	May 15	2A District 1 & 2 Bi-District Championship Meet	V	F
3	4:19.75	May 17	2A District 1 & 2 Bi-District Championship Meet	V	F
1	4:11.85 SR	May 25	2A, 3A, 4A State Championship Meet All Days	2A	F

3200 Meters

1	9:15.11	Mar 22	Bedlington Twilight	V	F
1	9:58.35	Mar 28	Lynden vs Squalicum	V	F
1	9:39.71	Apr 19	NWC Championship Meet	V	F
1	9:53.62	May 2	Mt. Baker & Squalicum @ Sehome	V	F
1	9:10.40	May 10	NWC 2A Sub District Meet	V	F
1	9:05.78	May 17	2A District 1 & 2 Bi-District Championship Meet	V	F
2	9:01.80 PR	May 25	2A, 3A, 4A State Championship Meet All Days	2A	F

4x400 Relay

8	4:06.8h	Mar 15	Squalicum, Bellingham, and Sehome	V	F
Patrick Gibson, Nick Gallaher, North Bennett, Dillon Rinauro					
1	3:36.0h	May 2	Mt. Baker & Squalicum @ Sehome	V	F
Patrick Gibson, Chais Sugden, Christopher Fredlund, Nick Gallaher					

2012 Outdoor Season

Squalicum HS

11th Grade

400 Meters - Relay Split

56.6h	Mar 16	"City Meet" BHS, SQHS, at Sehome	V	F
54.7h PR	Mar 29	Squalicum w/ Ferndale, Sehome	V	F

800 Meters

1	1:59.69	Mar 16	"City Meet" BHS, SQHS, at Sehome	V	F
2	1:59.3h SR	Apr 28	Tomahawk T&F Classic	V	F

1600 Meters

1	4:39.66	Mar 21	Squalicum w/ Burlington-Edison	V	F
1	4:25.0h	Mar 23	Bedlington Twilight	V	F
1	4:37.7h	Mar 29	Squalicum w/ Ferndale, Sehome	V	F
1	4:18.4h	Apr 20	NWC Championships	V	F
1	4:30.0h	Apr 26	Mt. Baker, Squalicum at Blaine	V	F
5	4:50.11	May 2	Mt. Vernon, Squalicum at LC	V	F
1	4:19.00	May 9	NWC 2A SubDistrict Meet - Day 1	V	F
1	4:19.00	May 11	NWC 2A SubDistrict Meet - Day 2	V	F
1	4:21.52	May 16	2A Northwest District 1 - Day 1	V	F
1	4:21.52	May 18	2A Northwest District 1 - Day 2	V	F
2	4:11.29 PR	May 26	2A WIAA State Championships - All Days	2A	F

Customize

Training Log

5/8	NWC 2A Sub District Meet	0.99 mi.
5/10	NWC 2A Sub District Meet	2.98 mi.
5/15	2A District 1 & 2 Bi-District Cham...	0.99 mi.
5/17	2A District 1 & 2 Bi-District Cham...	2.98 mi.
5/25	2A, 3A, 4A State Championship ...	2.98 mi.

Is this your athlete profile?

Claim this athlete to start tracking your workouts!

Claim this Athlete

Season Records

400 Meters - Relay Split

2011 Outdoor	10	55.44c
2012 Outdoor	11	54.84c PR *

800 Meters

2010 Outdoor	9	2:08.53
2011 Outdoor	10	2:03.6h *
2012 Outdoor	11	1:59.3h *
2013 Outdoor	12	1:58.13 PR *

1600 Meters

2010 Outdoor	9	4:29.26
2011 Outdoor	10	4:20.62 *
2012 Outdoor	11	4:11.29 PR *
2013 Outdoor	12	4:11.85

1 Mile

2012 Indoor	11	4:18.23 PR
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3000 Meters

# Methodology

Athletes:

- 400 Meters - 826 athletes
- 1600 Meters - 2056 athletes
- Competed all 4 years in high school
- Graduated between 2006 and 2017

Features
Athlete Name (& ID)
Athlete Sex
9 <sup>th</sup> grade PR
10 <sup>th</sup> grade PR
11 <sup>th</sup> grade PR
12 <sup>th</sup> grade PR
<del>School</del>
Athletic District
Graduation Year



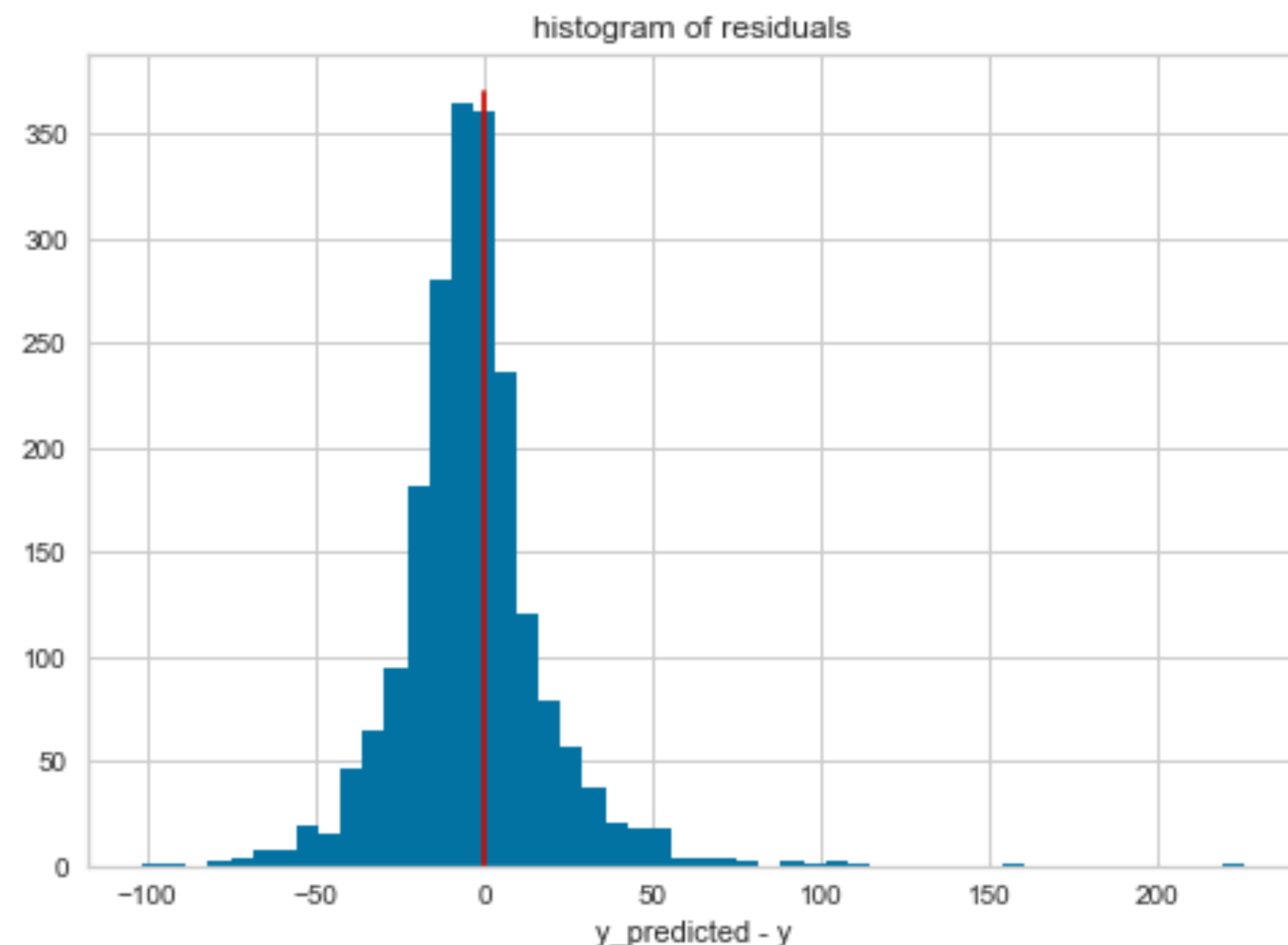
Athletic Districts in Washington State

# Results

## Algebraic Model

Assume constant growth rate

$$\frac{t_{12}}{t_{11}} = \frac{t_{11}}{t_{10}}$$



400 Meters.      mean = 58.4 seconds

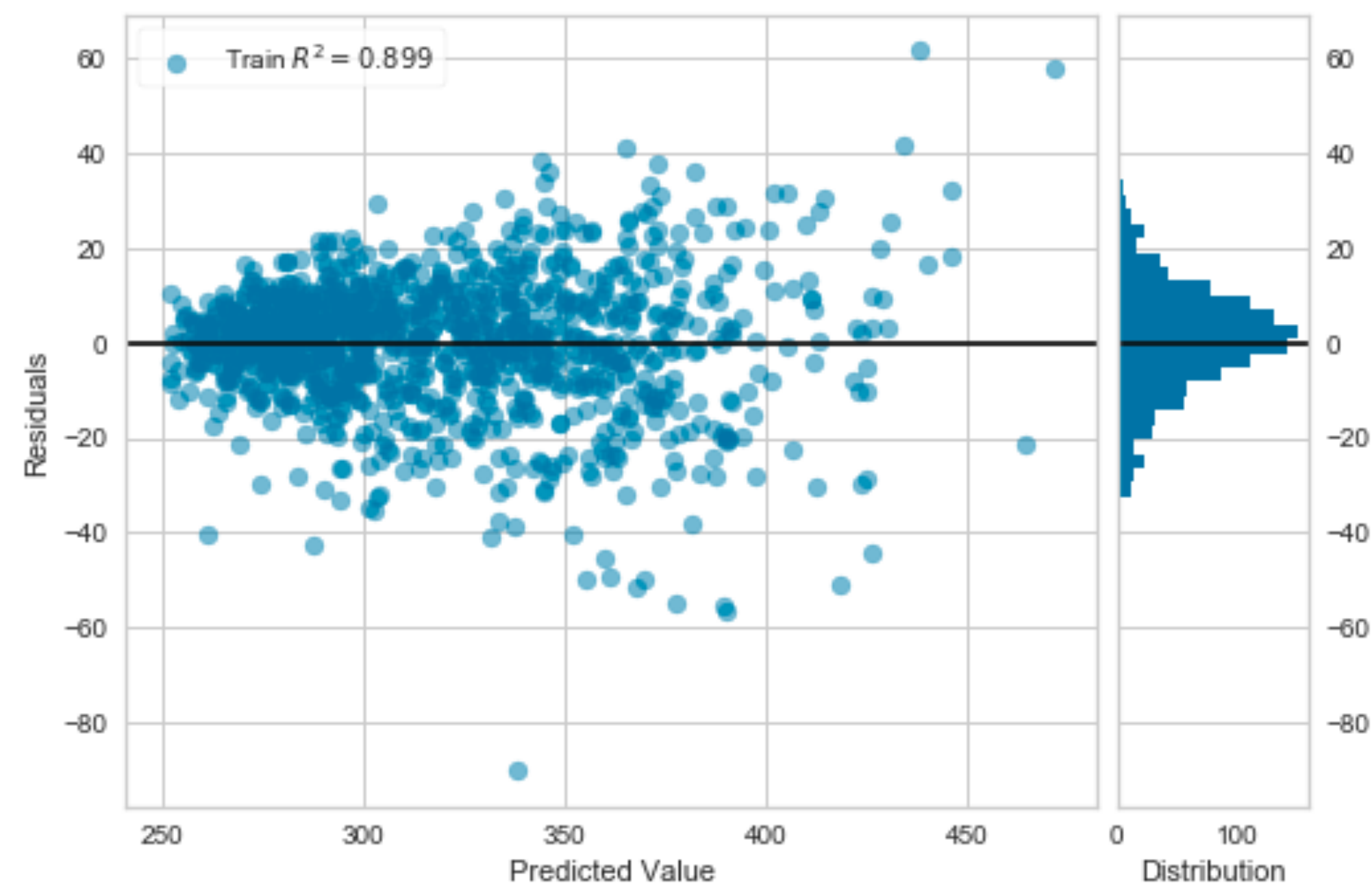
Model	RMSE
Algebra	3.7 (6.3%)
Linear regression	
Mixed Effects Model	
Add higher order terms to LR	

1600 Meters      mean = 317.0 seconds

Model	RMSE
Algebra	21.6 (6.8%)
Linear regression	
Mixed Effects Model	
Add higher order terms to LR	



# Linear Regression



400 Meters.      mean = 58.4 seconds

Model	RMSE
Algebra	3.7 (6.3%)
Linear regression	2.2 (3.7%)
Mixed Effects Model	2.1
Add higher order terms to LR	2.3

1600 Meters      mean = 317.0 seconds

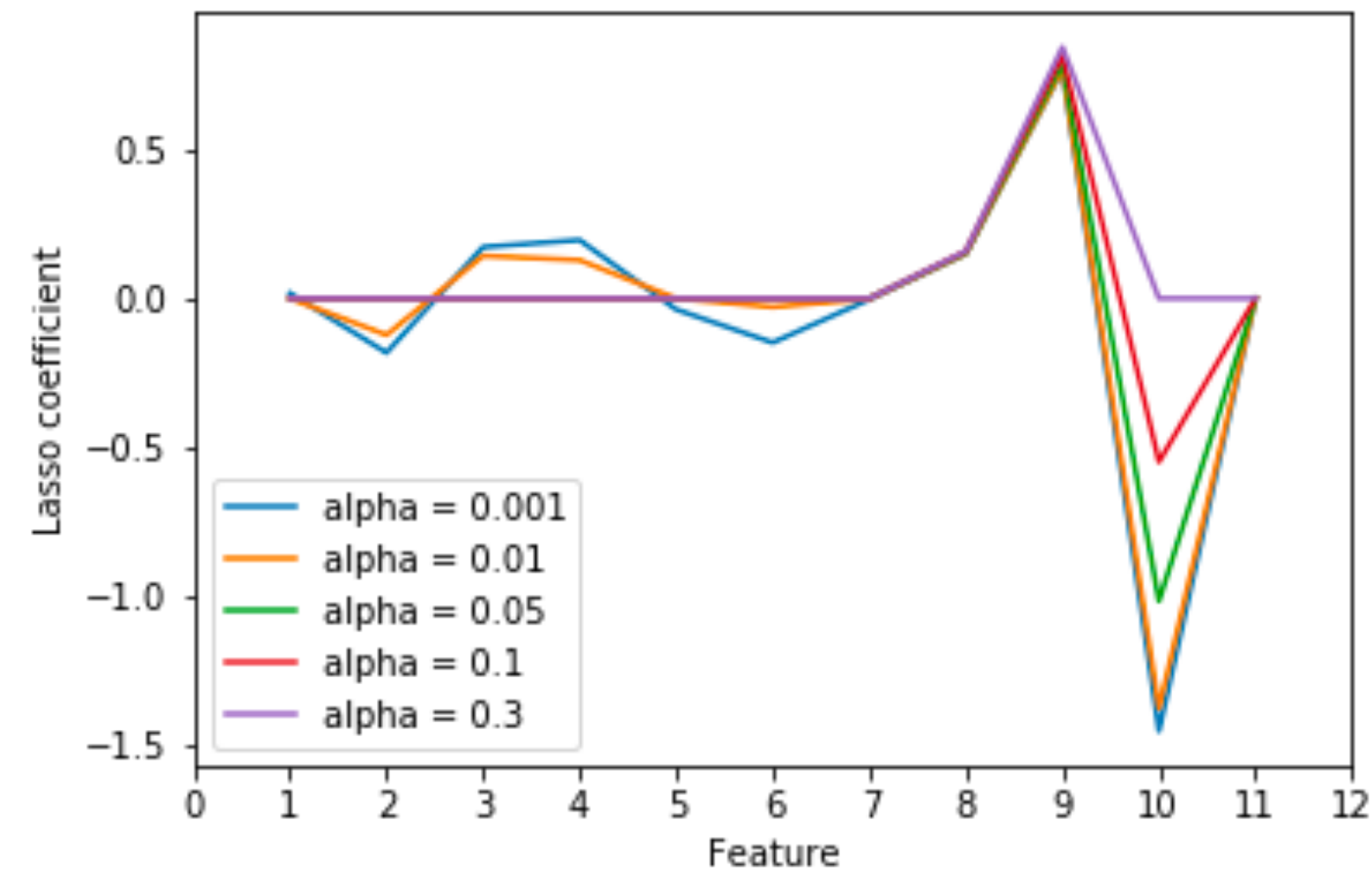
Model	RMSE
Algebra	21.6 (6.8%)
Linear regression	13.5 (4.3%)
Mixed Effects Model	13.6
Add higher order terms to LR	13.4

Mixed Effects Model  
District as mixed effect

Add second order terms for  
(10<sup>th</sup> grade PR)<sup>2</sup>  
(11<sup>th</sup> grade PR)<sup>2</sup>

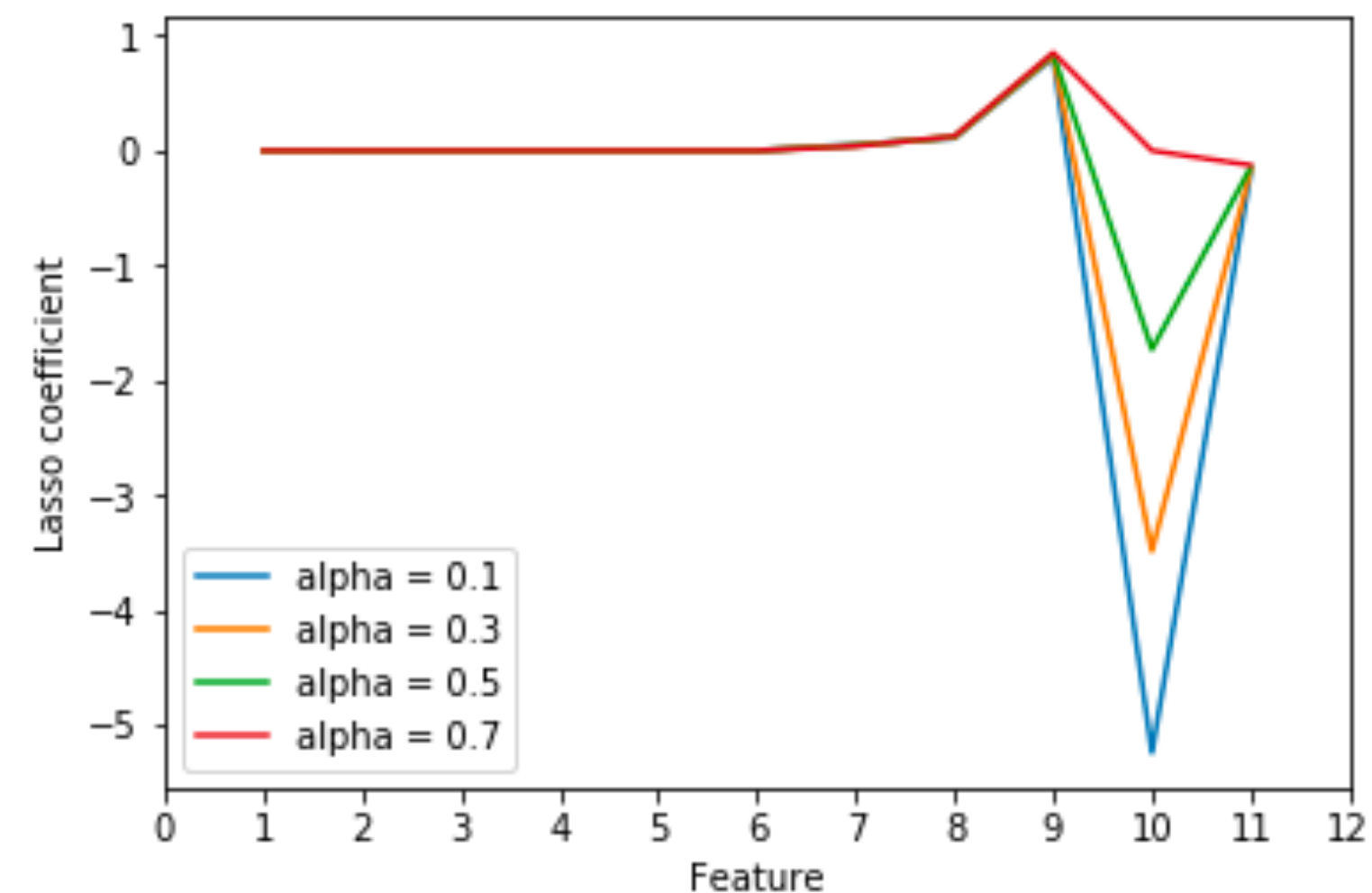
# Lasso

400 Meters



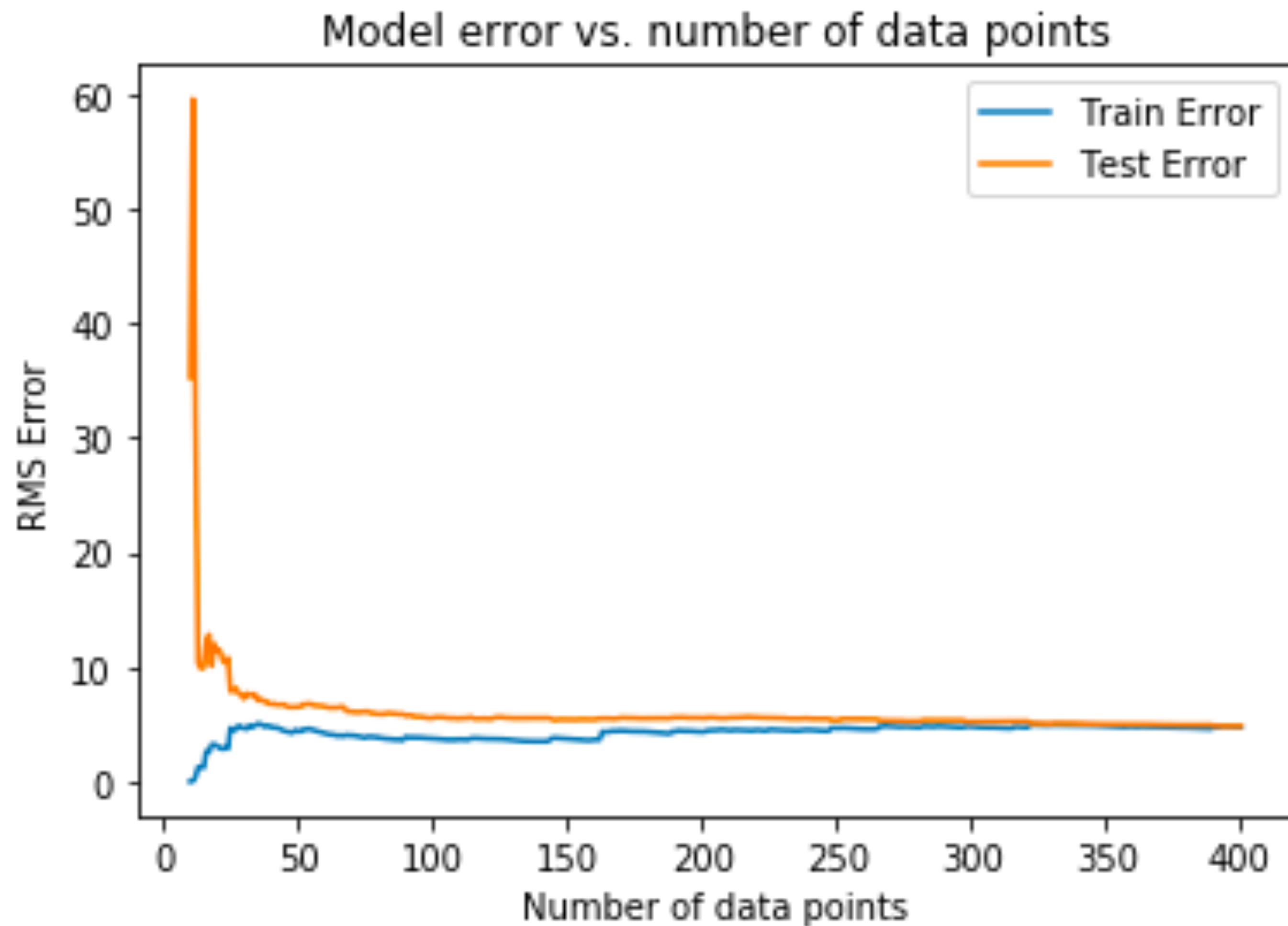
- **11<sup>th</sup> grade time**
- **10<sup>th</sup> grade time**
- Sex
- Athletic district becomes important

1600 Meters



- **11<sup>th</sup> grade time**
- Sex
- Graduation year becomes important

# Effect of #data points on model



It is possible to model with relatively few points

# Conclusions

- Machine learning models offer improvement over the algebraic model
- Require more features to get better prediction



# Future Work

- Add more features
  - Times for individual races
- Use this technique to predict field events
- Extrapolate to predict college times based on high school times (for recruiting)

# Appendix

Data sources:

Washington State Athletic Districts

<http://www.wiaa.com/subcontent.aspx?SecID=379>

Track & Field data

[www.athletic.net](http://www.athletic.net)