

# Marathon Results and Weather Conditions

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# **Project Objective:**

**Estimate the average time it will take a division to complete a marathon based on the day's weather conditions.**



In any marathon or outdoors sporting event, the weather conditions will always have a huge impact. Temperature interacts with the humidity, which makes it harder to sweat and makes it harder for the athlete to stay cool.

Any rain at all, meanwhile, will add water and weight to clothing and footwear, draining energy faster; and running into the wind, or even being buffeted by variable wind adds drag and slows the runner.

# The Events



## ABBOTT WORLD MARATHON MAJORS MEMBER CITIES:



**TOKYO  
MARATHON**



**VIRGIN  
MONEY  
LONDON  
MARATHON**



**B.A.A.  
BOSTON  
MARATHON**



**BMW  
BERLIN  
MARATHON**

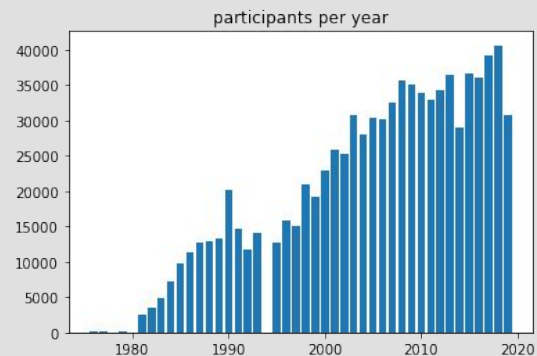
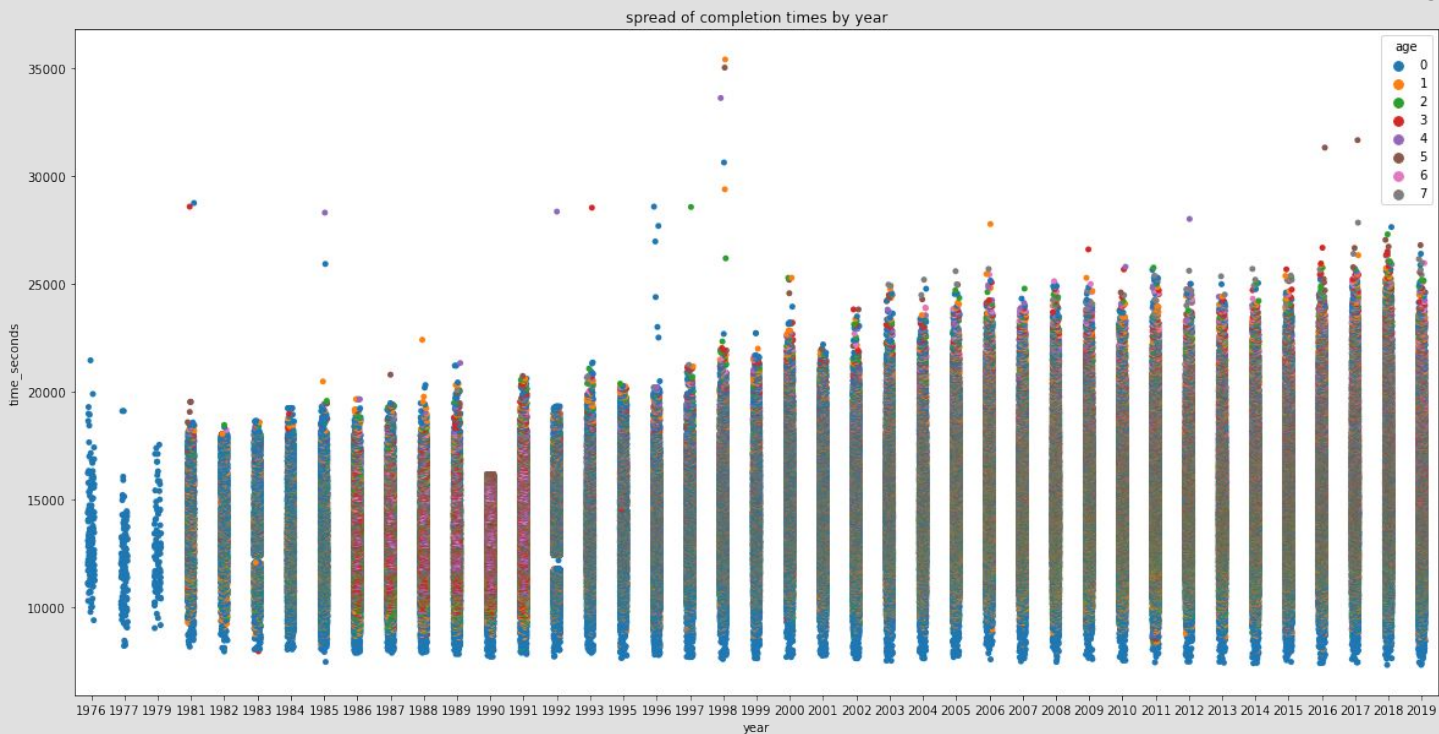


**BANK  
OF AMERICA  
CHICAGO  
MARATHON**

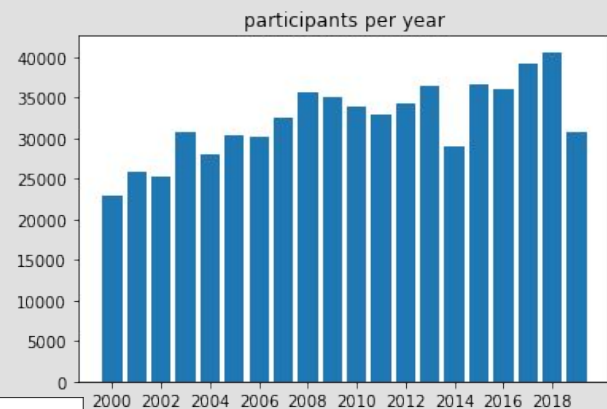
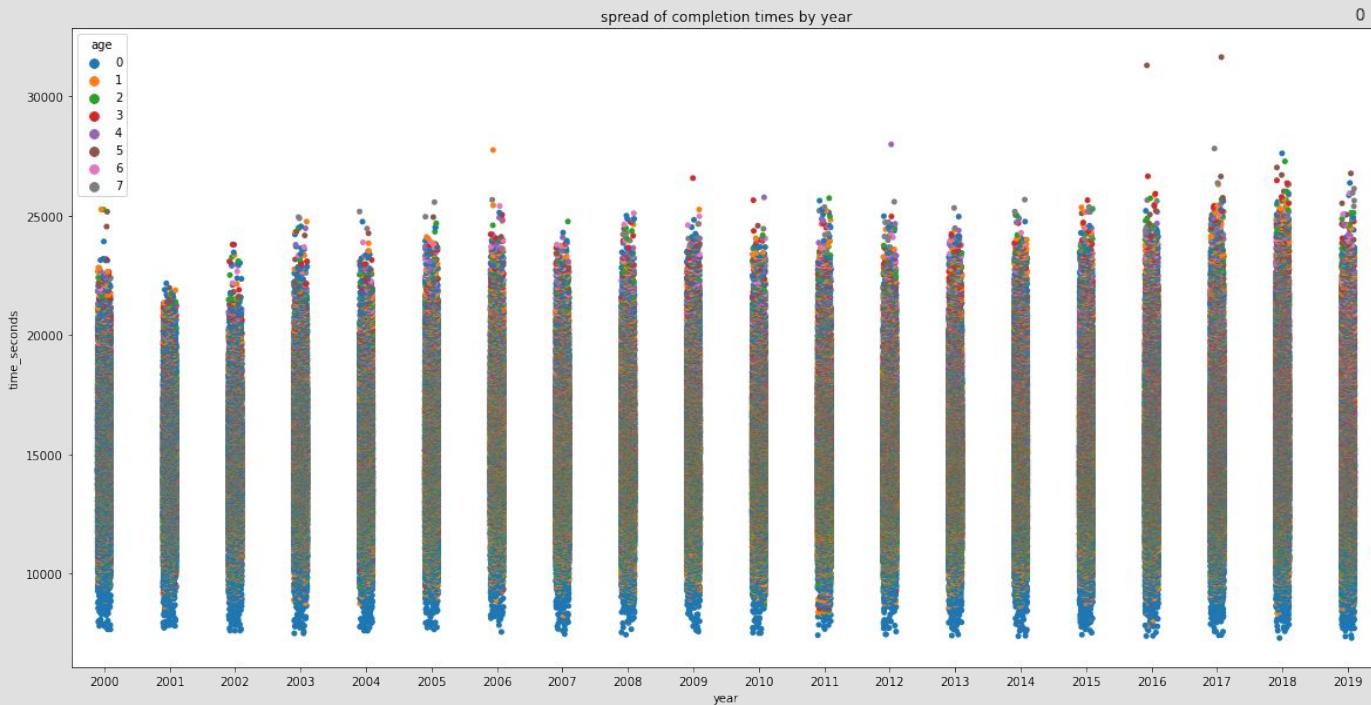


**TCS  
NEW YORK  
CITY  
MARATHON**

# Berlin Marathon (All Years)



# Berlin Marathon (2000 Onward)



# Features

## Athlete

- Male or Female
- Age Group
  - 18-39
  - 40-44
  - 45-49
  - 50-54
  - 55-59
  - 60-64
  - 65-69
  - 70+

## Weather Numerical

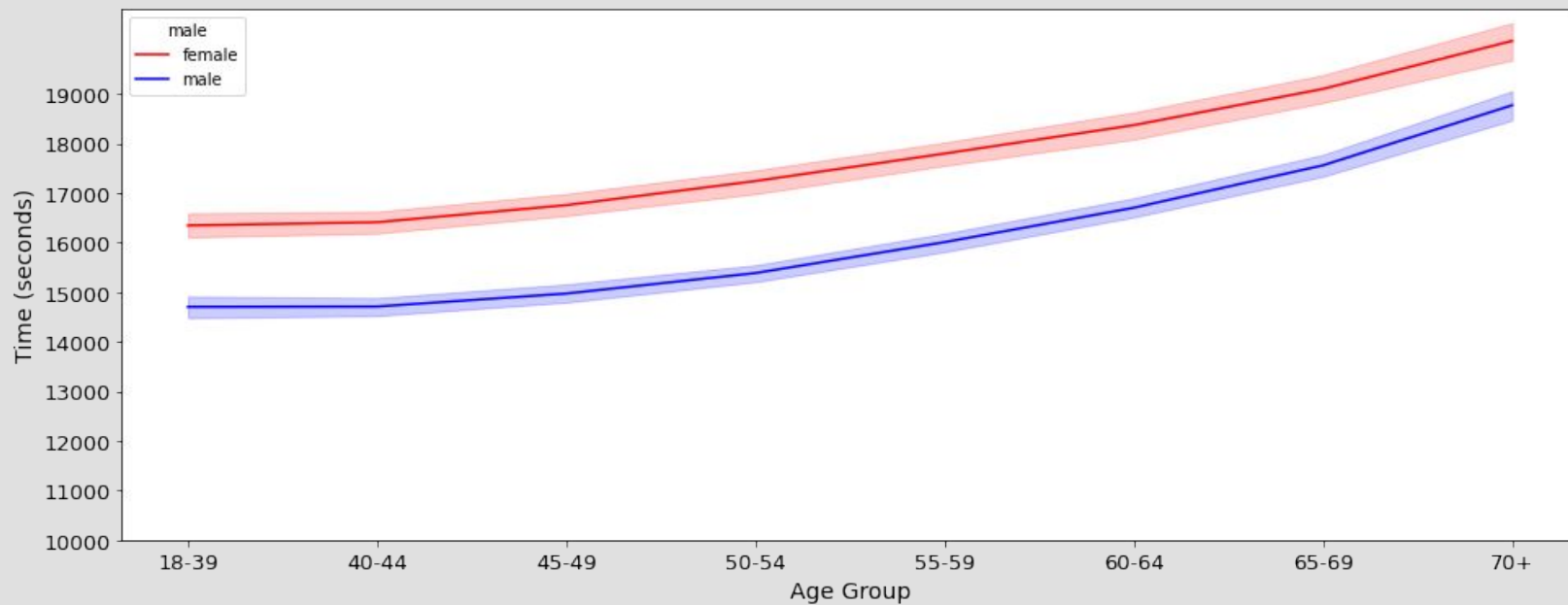
- Temperature
- Relative Humidity
- Wind Speed
- Precipitation
- Precipitation Cover
- Cloud Cover

## Weather Categorical

- Clear
- Partially Cloudy
- Overcast
- Rain

# Gender

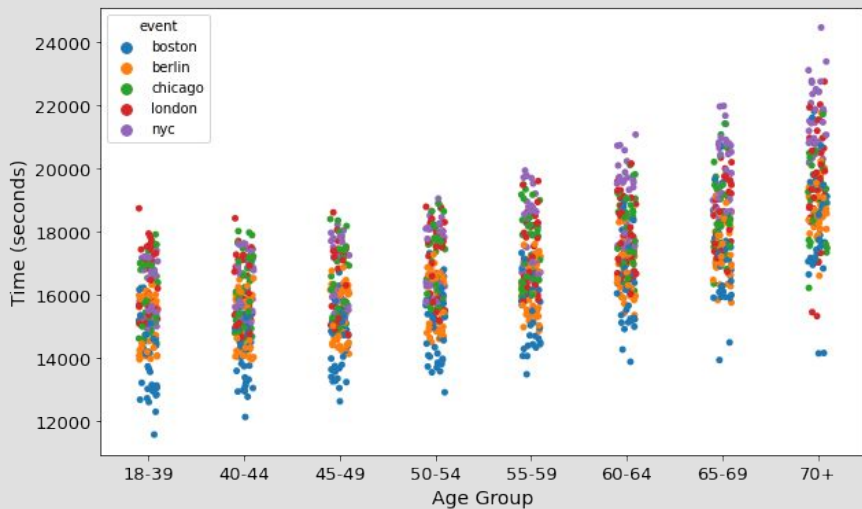
Distribution of marathon finish times (in seconds) by age group and gender



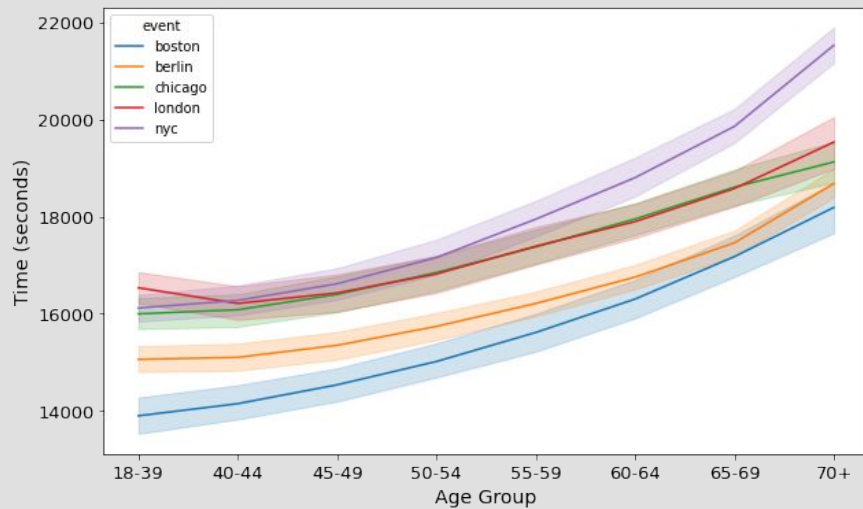


# Age Groups

Distribution of marathon finish times (in seconds) by age group and event



Distribution of marathon finish times (in seconds) by age group and event



# Model Performances (MAE)

	Linear	Ridge	Lasso	Elastic Net	XGBoost	GLM
Berlin	334	376	356	336	349	366
Boston	626	1072	1143	1048	1087	1024
Chicago	530	592	675	522	373	578
London	414	503	513	399	409	412
NYC	265	579	284	256	304	331
Combined	556	971	978	493	897	1146

**What do the models actually tell us?**

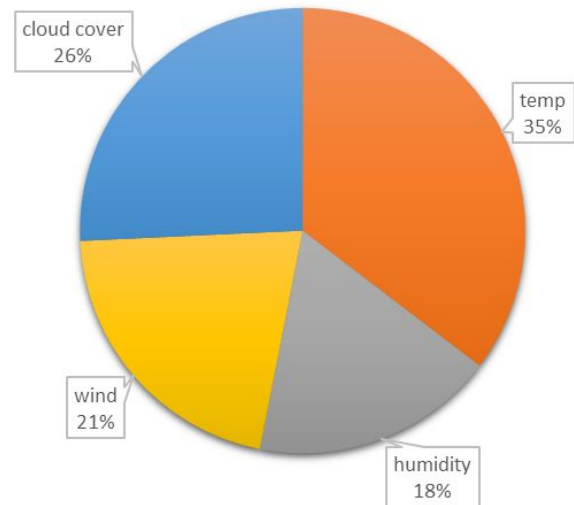
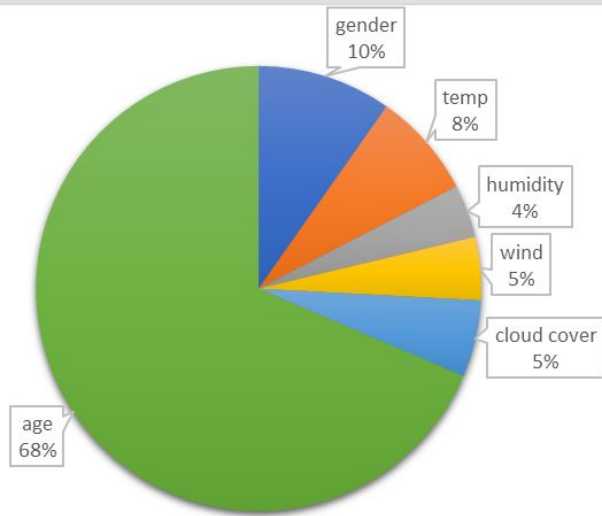
# Athlete Coefficients

	Male	40-44	45-49	50-54	55-59	60-64	65-69	70+
Berlin	-1480	21	261	648	1104	1634	2309	3569
Boston	-1436	245	634	1121	1727	2379	3233	4174
London	-1880	-506	-285	0	558	1108	1729	2721
NYC	-1899	-89	299	827	1645	2496	3537	5090
Combined	-1643	-4	291	756	1355	1987	2753	3784

# Weather Coefficients

	Temp (F)	Humidity (%)	Wind (mph)	Precipitation (in)	Cloud Cover (%)
Berlin	24	-6.57	7.43	0	-5.13
Boston	86	10.39	2.47	1795	-14.87
London	27	-12.46	38.3	0	-6.42
NYC	34	-3.38	6.18	0	12.74
Combined	49	-8.21	17.39	0	3.5

# Chicago



# What's Next?

1. Account for changes in elevation / altitude
2. Additional years for greater variety in weather conditions
3. Find the curve that temperature follows

## World Marathon Majors: Course Profiles



*\*All values are approximate and based off a sample of barometric data taken from Strava*

**Any Questions?**