Formula 1 Race Predictions

by Gregory Han

Formula 1

- Formula One (Formula 1 or F1) is the highest class of international single-seater auto racing sanctioned by the Fédération Internationale de l'Automobile (FIA) and owned by the Formula One Group.
- A Formula 1 season consists of a series of races, known as Grand Prix, which are taken place worldwide. The cars are the fastest regulated racing cars, driven by the best drivers and developed by renowned constructors such as Mercedes and Ferrari. It takes a combination of driver skill, quality build of the car, and racing strategy to ultimately win a single Grand Prix.
- Tasked to make lap-by-lap race predictions to show live so it can help potential sponsors decide which drivers/constructors to invest in, for fans to have better experience viewing the race, and constructors to see how the competition is doing to make adjustments to their racing strategy in real-time.

Task Overview

Data & Methods

- Provided by Ergast Developer API
- 2001-2020 dataset with 25,000+ race results
- Data Exploration / Optimization

Machine Learning

- Modelling using LSTM & PyTorch

Race Predictions

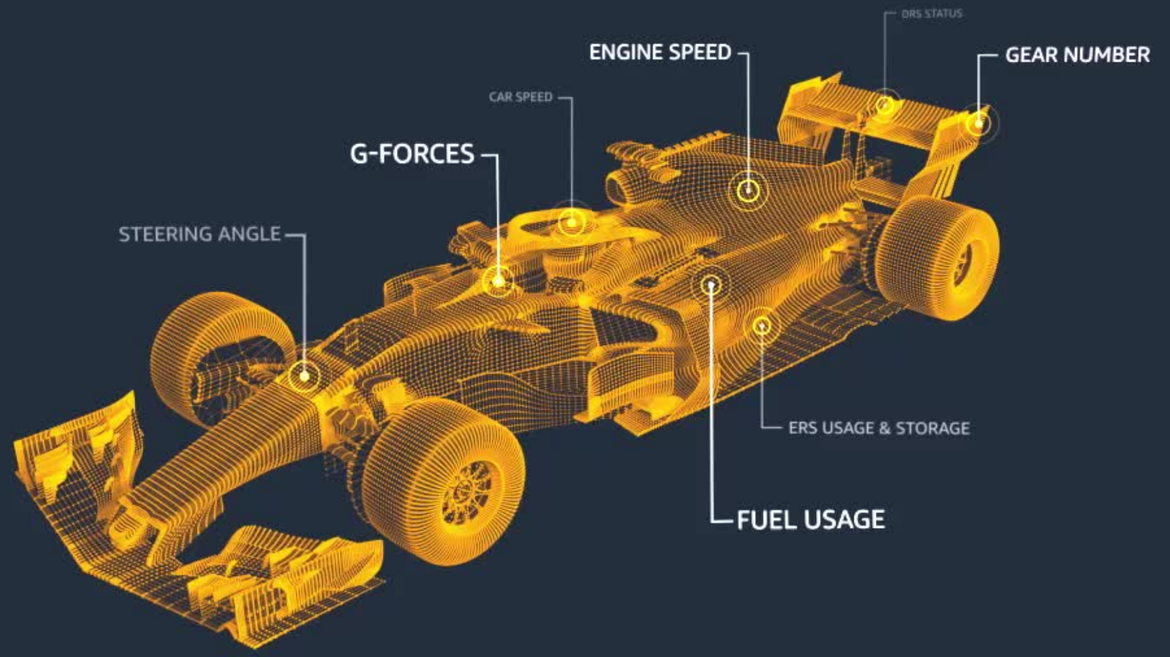
- Comparison of sample predictions vs. actual results (2020 Abu Dhabi)

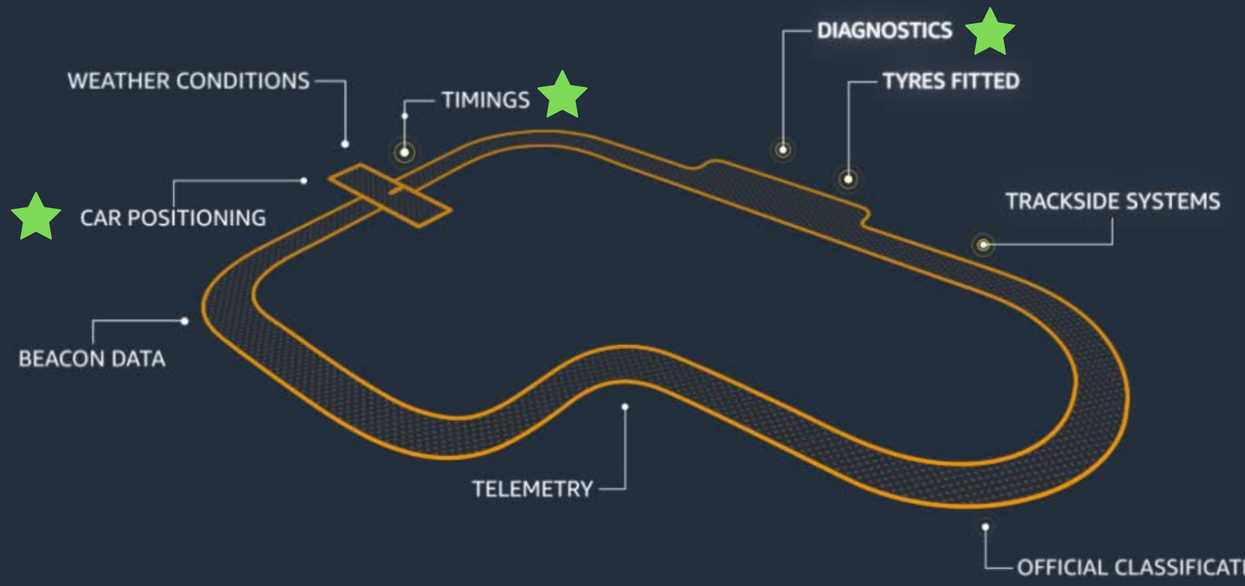
Lap-by-lap Predictions

- Streamlit demonstration

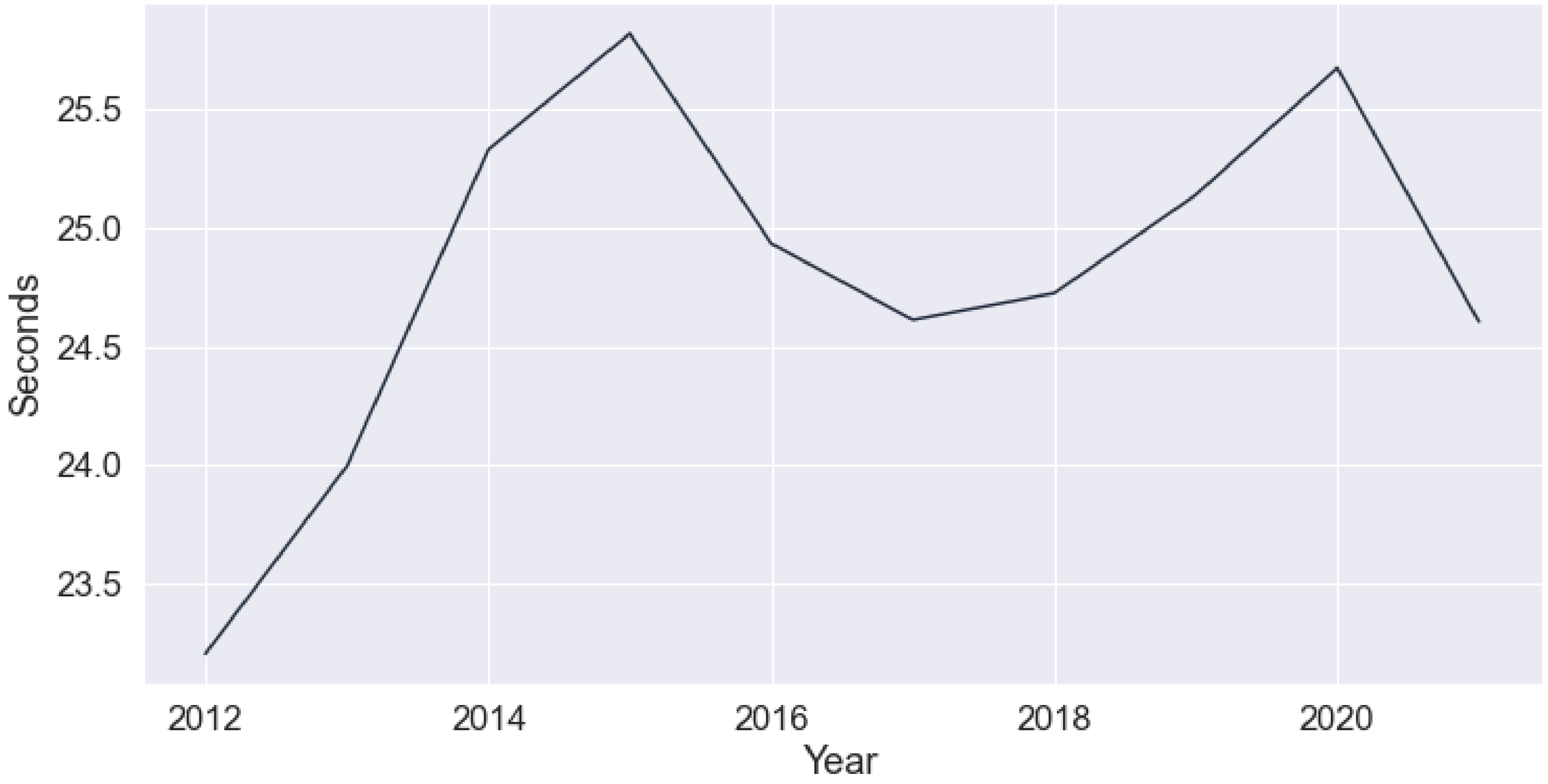
Data & Methods

- Ergast Developer API
- 25,000+ race results
- 2001 - 2021
- Modelling
- Optimization

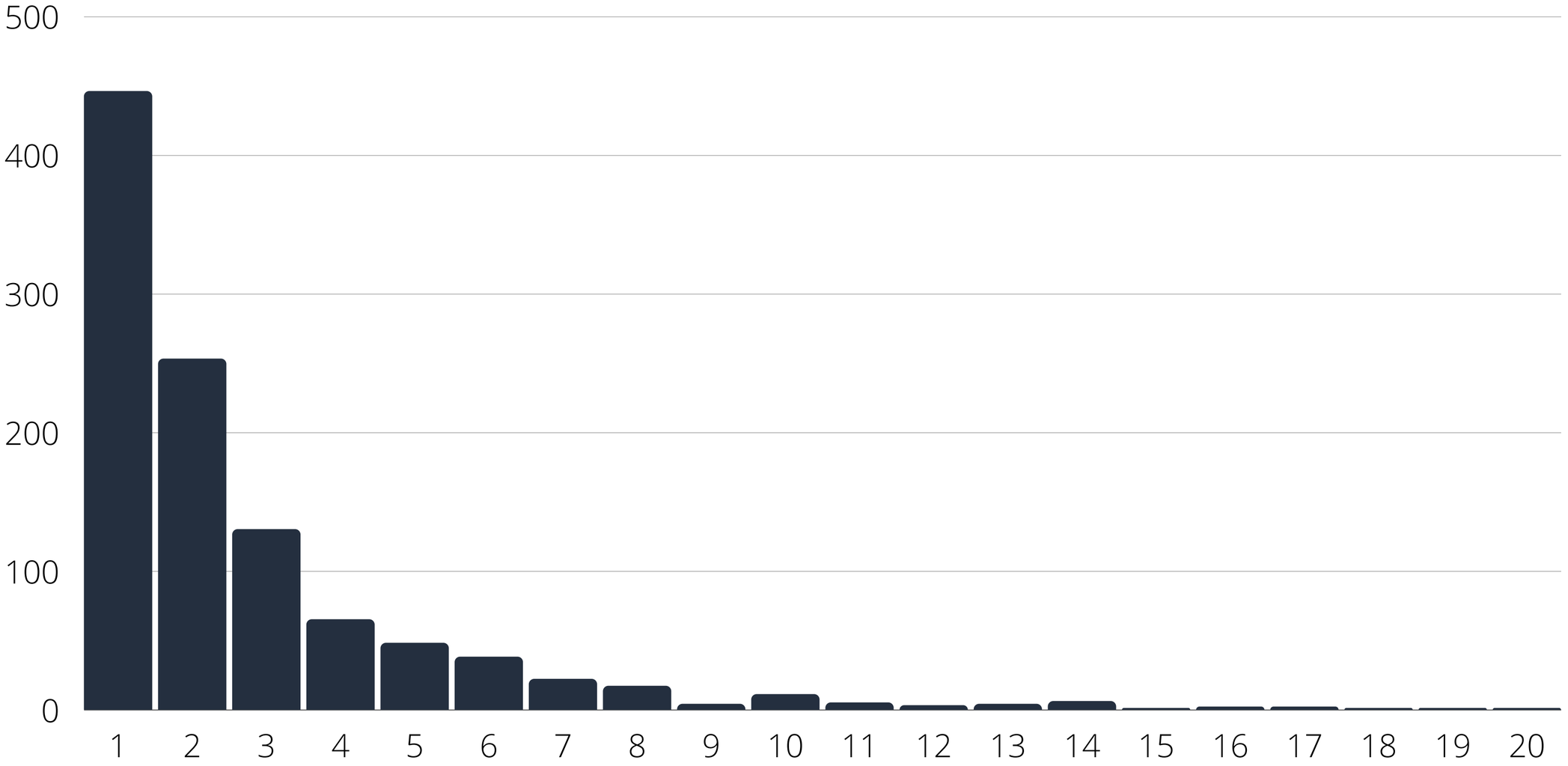




Pit Times



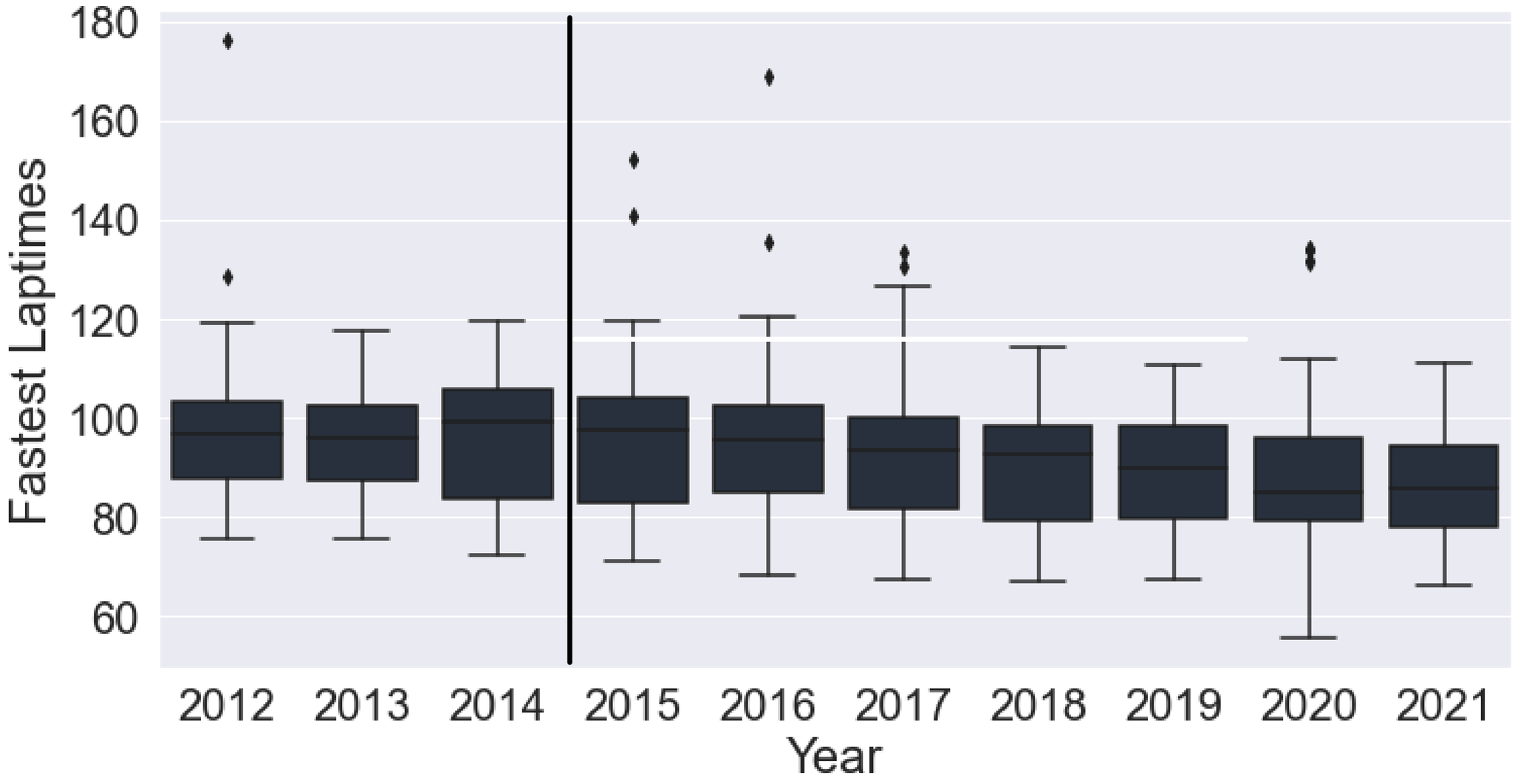
Started from the bottom...



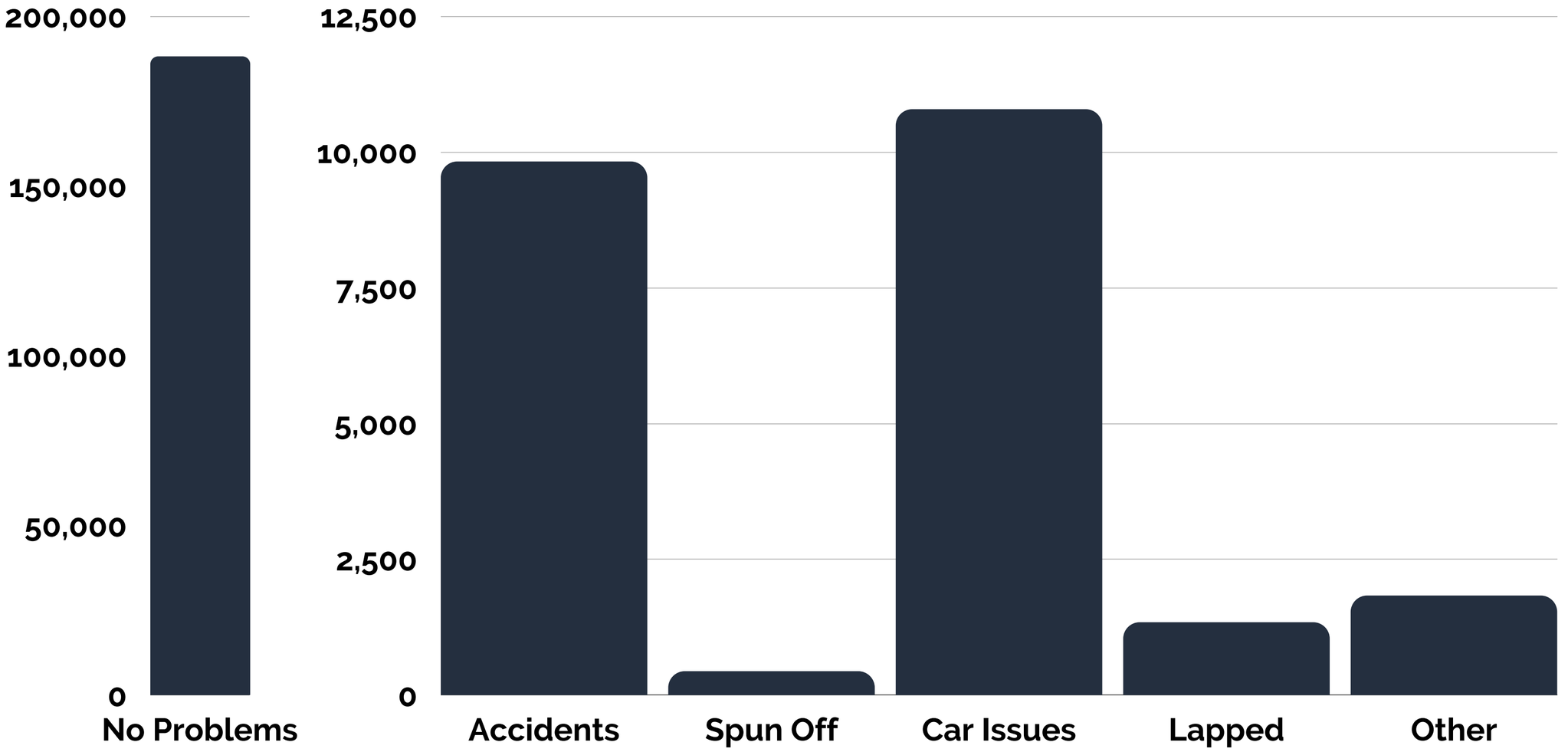
...now I've won

02

Fastest Laptimes



Status of Cars



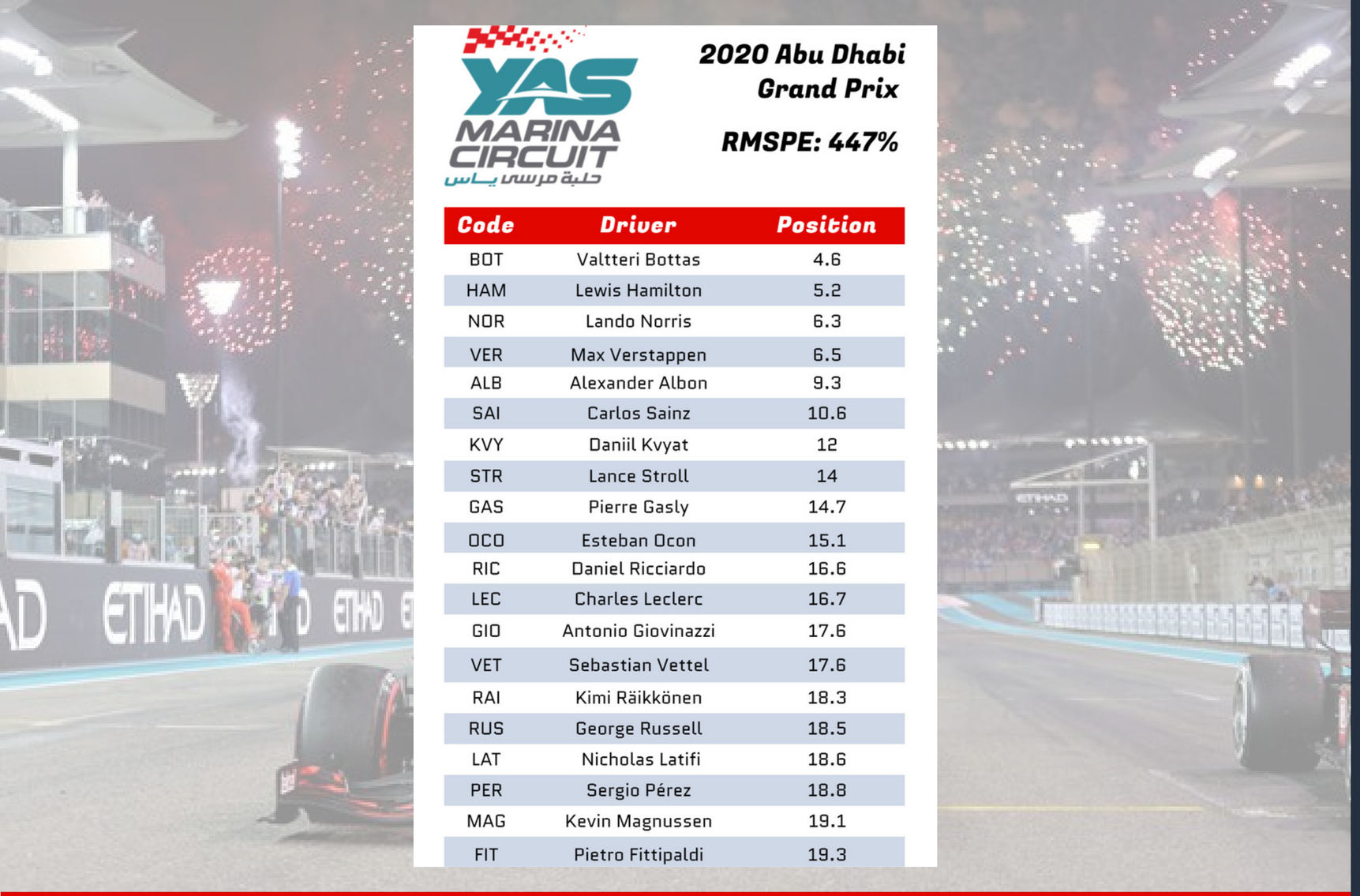
Modelling
LSTM & PyTorch

Long Short Term Memory

- Type of RNN (recurrent neural network)
- Similar to the human brain
- Forget, Input, Output

PyTorch

- Developed by Facebook AI Research Team
- Library for processing tensors (deep learning)
- Static vs. Dynamic (PyTorch)



2020 Abu Dhabi Grand Prix

RMSPE: 447%

Code	Driver	Position
BOT	Valtteri Bottas	4.6
HAM	Lewis Hamilton	5.2
NOR	Lando Norris	6.3
VER	Max Verstappen	6.5
ALB	Alexander Albon	9.3
SAI	Carlos Sainz	10.6
KVY	Daniil Kvyat	12
STR	Lance Stroll	14
GAS	Pierre Gasly	14.7
OCO	Esteban Ocon	15.1
RIC	Daniel Ricciardo	16.6
LEC	Charles Leclerc	16.7
GIO	Antonio Giovinazzi	17.6
VET	Sebastian Vettel	17.6
RAI	Kimi Räikkönen	18.3
RUS	George Russell	18.5
LAT	Nicholas Latifi	18.6
PER	Sergio Pérez	18.8
MAG	Kevin Magnussen	19.1
FIT	Pietro Fittipaldi	19.3

Baseline Model

Final Model

2020 Abu Dhabi Grand Prix

RMSPE: 25%

Code	Driver	Position	Status	Laptime
VER	Max Verstappen	1	No Problem	104.0
BOT	Valtteri Bottas	2	No Problem	104.0
HAM	Lewis Hamilton	3	No Problem	194.3
NOR	Lando Norris	4	No Problem	195.7
ALB	Alexander Albon	5	No Problem	105.0
SAI	Carlos Sainz	6	No Problem	105.0
KVY	Daniil Kvyat	7	No Problem	105.0
GAS	Pierre Gasly	7	No Problem	105.0
STR	Lance Stroll	8	No Problem	105.0
OCO	Esteban Ocon	9	No Problem	105.3
LEC	Charles Leclerc	11	No Problem	116.4
RIC	Daniel Ricciardo	11	No Problem	105.0
VET	Sebastian Vettel	12	No Problem	106.0
GIO	Antonio Giovinazzi	13	No Problem	107.0
RAI	Kimi Räikkönen	14	No Problem	100.0
LAT	Nicholas Latifi	21	Accident/Collision	106.0
RUS	George Russell	21	Accident/Collision	100.0
FIT	Pietro Fittipaldi	21	Car Issues	100.0
PER	Sergio Pérez	21	Accident/Collision	100.0
MAG	Kevin Magnussen	21	Car Issues	100.0

2020 Abu Dhabi Grand Prix
Predicted Result

Code	Driver	Position	vs. Actual	Status	Laptime
VER	Max Verstappen	1	★	No problem	104.0
BOT	Valterri Bottas	2	★	No problem	104.0
HAM	Lewis Hamilton	3	★	No problem	194.3
NOR	Lando Norris	4	+1	No problem	195.7
ALB	Alexander Albon	5	-1	No problem	105.0
SAI	Carlos Sainz	6	★	No problem	105.0
KVY	Daniil Kvyat	7	+4	No problem	105.0
GAS	Pierre Gasly	7	★	No problem	105.0
STR	Lance Stroll	8	+1	No problem	105.0
OCO	Esteban Ocon	9	-1	No problem	105.3
LEC	Charles Leclerc	11	+2	No problem	116.4
RIC	Daniel Ricciardo	11	-5	No problem	105.0
VET	Sebastian Vettel	12	-1	No problem	106.0
GIO	Antonio Giovinazzi	13	-2	No problem	107.0
RAI	Kimi Räikkönen	14	+3	No problem	100.0
LAT	Nicholas Latifi	21	-4	Accident/Collision	100.0
RUS	George Russell	21	-6	Accident/Collision	100.0
FIT	Pietro Fittipaldi	21	-2	Car Issues	100.0
PER	Sergio Pérez	21	★	Accident/Collision	100.0
MAG	Kevin Magnussen	21	-3	Car Issues	100.0

vs.

2020 Abu Dhabi Grand Prix
Actual Result

Code	Driver	Position	Status	Laptime
VER	Max Verstappen	1	No Problem	100.9
BOT	Valtteri Bottas	2	No Problem	101.1
HAM	Lewis Hamilton	3	No Problem	101.4
ALB	Alexander Albon	4	No Problem	101.2
NOR	Lando Norris	5	No Problem	102.0
SAI	Carlos Sainz	6	No Problem	101.9
RIC	Daniel Ricciardo	7	No Problem	100.9
GAS	Pierre Gasly	8	No Problem	102.5
OCO	Esteban Ocon	9	No Problem	102.9
STR	Lance Stroll	10	No Problem	101.9
KVY	Daniil Kvyat	11	No Problem	102.7
RAI	Kimi Räikkönen	12	No Problem	102.1
LEC	Charles Leclerc	13	No Problem	101.9
VET	Sebastian Vettel	14	No Problem	101.5
RUS	George Russell	15	No Problem	103.3
GIO	Antonio Giovinazzi	16	No Problem	101.7
LAT	Nicholas Latifi	17	No Problem	102.5
MAG	Kevin Magnussen	18	No Problem	102.0
FIT	Pietro Fittipaldi	19	No Problem	101.7
PER	Sergio Perez	21	Car Issues	103.3

Formula One

Race Predictions

Prediction Demonstration

Conclusion

- Better predictions inclusive of other factors such as track conditions, tire quality, and introduction of sprints
- Accounting for unpredictable and random events such as weather patterns and penalties
- Cloud computing to access and analyze the 1.1 million data points transmitted per second from cars/pits
- Usage of machine learning to develop faster cars, race strategy, and insights onscreen for fans

Any questions?

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APPENDIX