

# Analysis of International Airline Ticket Prices

FROM **norwegian** 

# PREDICTING INT'L AIRFARE – SUMMARY

FLIGHT DATA

90

days starting

June 2, 2019

4,400+  
flights

PRODUCTION

Predicting Airfare  
via  
Linear Reg. Model

Producing:



Flask

## NORWEGIAN AIR FLIGHT ITINERARIES

I ✕ OAK

JFK



LAX

Los Angeles World Airports



Gatwick  
LONDON AIRPORT

Stockholm  
Arlanda Airport  
SWEDAVIA SWEDISH AIRPORTS



Aeropuerto de Barcelona-El Prat

# OVERVIEW – DATA COLLECTION

STANDARD PAGE FORMAT

## Flights to Copenhagen from New York-JFK

Select departure and start reservation. All fares per person in USD. Restrictions, baggage fee and credit card surcharge

Fly from New York-JFK (JFK) ▾ ☐ Return Outbound 05 ▾ Jun 2019 ▾ ☐ Adults 1 ▾ Children 1 ▾  
Fly to Copenhagen (CPH) ▾ ☐ Show direct only Return 05 ▾ Jun 2019 ▾ ☐ Infants

Outbound: New York-JFK - Copenhagen

Wednesday 5. Jun 2019

### Compare fare types

Departure	Arrival	Economy cabin All fares per person in USD			Premium cabin All fares per person in USD	
		LowFare	LowFare+	Flex	Premium	PremiumFlex
23:00 New York-JFK Direct Duration: 7h 35m ① The 787 Dreamliner	13:06 +1 Copenhagen	469.90	559.90	764.90	-	1,094.90
23:00 New York-JFK 1 stop Duration: 11h 25m ① The 787 Dreamliner ② 1 stop (2h 35m) in London	18:25 +1 Copenhagen	516.00	606.00	1,066.00	1,096.00 Premium on parts of route	1,286.00 Premium on parts of route
22:25 New York-JFK 1 stop Duration: 12h 0m ① The 787 Dreamliner ② 1 stop (3h 10m) in London	18:25 +1 Copenhagen	566.00	656.00	1,066.00	1,096.00 Premium on parts of route	1,286.00 Premium on parts of route
23:00 New York-JFK 1 stop Duration: 13h 15m ① The 787 Dreamliner ② 1 stop (4h 25m) in London	18:16 +1 Copenhagen	523.60 Only 2 seats with this price	613.60 Only 2 seats with this price	1,066.00	1,103.60 Premium on parts of route	1,286.00 Premium on parts of route
23:55 New York-JFK 1 stop Duration: 13h 45m ① The 787 Dreamliner ② 1 stop (3h 25m) in Madrid	18:40 +1 Copenhagen	600.00	690.00	1,178.90	760.00 Premium on parts of route	1,208.90 Premium on parts of route

## WARNING:

Site structure sometimes changes....

[Notice only 3 price columns here]

## Flights to Copenhagen from Los Angeles

Select departure and start reservation. All fares per person in USD. Restrictions, baggage fee and credit card surcharge

Fly from Los Angeles (LAX) ▾ ☐ Return Outbound 09 ▾ Jun 2019 ▾ ☐ Adults 1 ▾ Children 1 ▾  
Fly to Copenhagen (CPH) ▾ ☐ Show direct only Return 09 ▾ Jun 2019 ▾ ☐ Infants

Outbound: Los Angeles - Copenhagen

Sunday 9. Jun 2019

### Compare fare types

Departure	Arrival	Details	All fares per person in USD		
			LowFare	LowFare+	Flex
20:30 Los Angeles ① The 787 Dreamliner ② 1 stop (1h 40m) in Oslo	18:35 +1 Copenhagen	1 stop Duration: 13h 5m	Sold out	Sold out	Sold out
19:30 Los Angeles ① The 787 Dreamliner ② 1 stop (1h 35m) in London	18:15 +1 Copenhagen	1 stop Duration: 13h 45m	950.00 Only 2 seats with this price	1,040.00 Only 2 seats with this price	1,186.00
20:30 Los Angeles ① The 787 Dreamliner ② 1 stop (2h 55m) in Oslo	19:50 +1 Copenhagen	1 stop Duration: 14h 20m	Sold out	Sold out	Sold out
19:30 Los Angeles ① The 787 Dreamliner ② 1 stop (6h 55m) in London	23:35 +1 Copenhagen	1 stop Duration: 19h 5m	836.00 Only 1 seat with this price	926.00 Only 1 seat with this price	1,186.00

# DATA EXPLORATORY ANALYSIS

## DATA SUMMARY

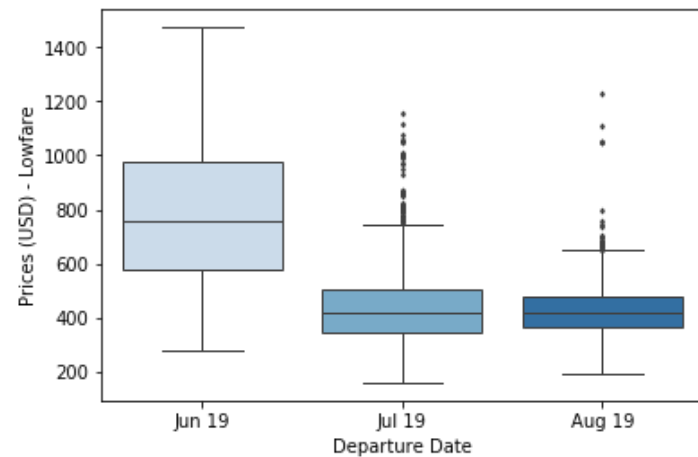
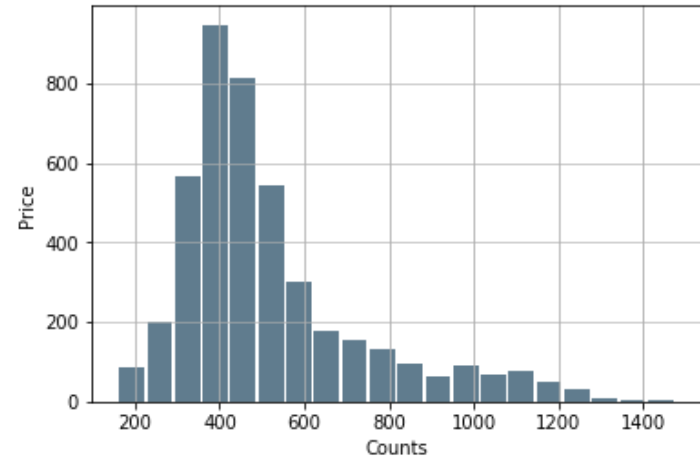
**UNFILTERED**  
4,847 x 34

**CLEANED**  
4,413 x 9

**3,600**  
Connecting  
**813**  
Direct Flights

orig_port_coded	dest_port_coded	days_to_flight	depart_yr	depart_mo	depart_day	duration_total_min	stops	prices_lowfare_USD
0	0	1.0	2019	6	3	690	1	1172.9
0	0	1.0	2019	6	3	750	1	772.9
0	0	1.0	2019	6	3	760	1	910.9
0	0	1.0	2019	6	3	920	1	1172.9
0	0	1.0	2019	6	3	980	1	772.9

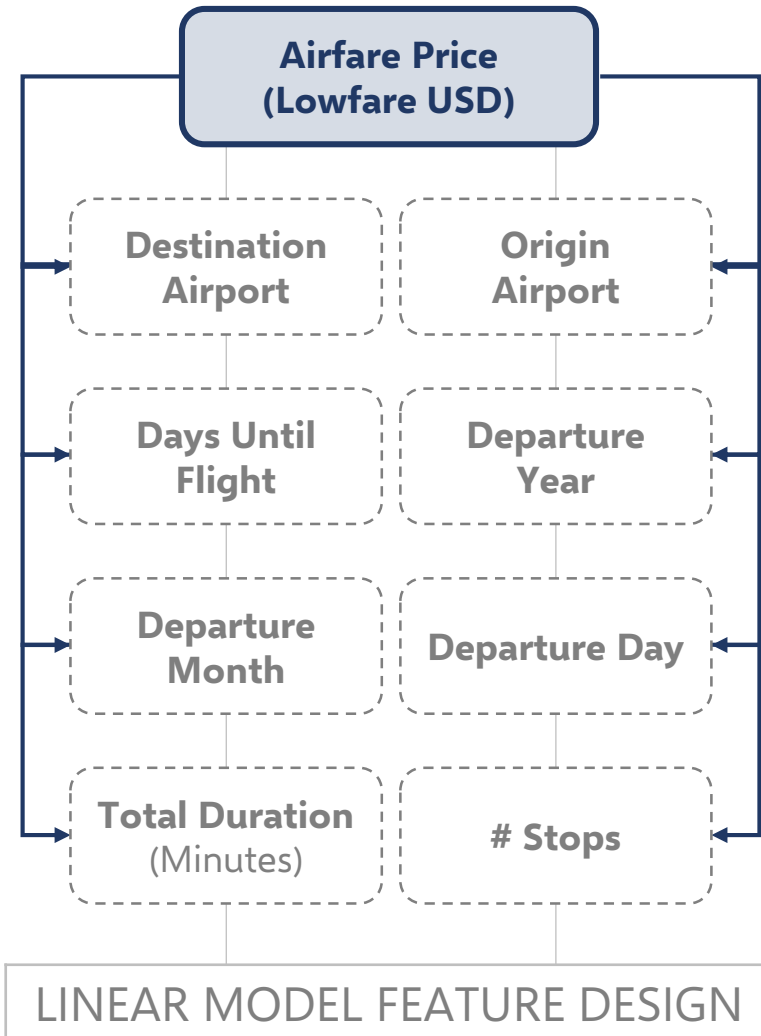
## PRICES



## STOP LOCATION

London	<b>1,109</b>	Madrid	<b>225</b>
Oslo	<b>840</b>	Amsterdam	<b>129</b>
Stockholm	<b>532</b>	Paris	<b>101</b>
Copenhagen	<b>361</b>	Rome	<b>64</b>
Barcelona	<b>239</b>		

# PREDICTIVE LINEAR MODEL & FLASK API



Flask +



Amazon EC2

REQUEST USING `curl`

```
curl -H "Content-Type: application/json" -X POST -d '{"orig_port_encoded": "0", "dest_port_encoded": "0", "days_to_flight": "10", "depart_yr": "2019", "depart_mo": "6", "depart_day": "13", "duration_total_min": "750", "stops": "1"}' "http://ec2-54-202-68-148.us-west-2.compute.amazonaws.com:5000/predict_airfare"
```

LAUNCHING FLASK API

```
[ec2-user@ip-172-31-27-175 docker]$ docker-compose up
Recreating docker_flask_1 ... done
Attaching to docker_flask_1
Flask_1   * Serving Flask app "server" (lazy loading)
Flask_1   * Environment: production
Flask_1   WARNING: Do not use the development server in a production environment.
Flask_1   Use a production WSGI server instead.
Flask_1   * Debug mode: on
Flask_1   * Running on http://0.0.0.0:5000/ (Press CTRL+C to quit)
Flask_1   * Restarting with stat
Flask_1   * Debugger is active!
Flask_1   * Debugger PIN: 690-542-898
Flask_1   72.197.183.122 - - [03/Jun/2019 07:51:28] "GET / HTTP/1.1" 200 -
```

EXAMPLE: REQUEST PREDICTION

```
Amazon Linux AMI
https://aws.amazon.com/amazon-linux-ami/2018.03-release-notes/
[ec2-user@ip-172-31-27-175 ~]$ curl -H "Content-Type: application/json" -X POST -d '{"orig_port_encoded": "0", "dest_port_encoded": "0", "days_to_flight": "10", "depart_yr": "2019", "depart_mo": "6", "depart_day": "13", "duration_total_min": "750", "stops": "1"}' "http://ec2-54-202-68-148.us-west-2.compute.amazonaws.com:5000/predict_airfare"
{"airfare_prediction": 432.46229448441675}
```

# CHALLENGES & FUTURE IMPROVEMENTS

## SITE STRUCTURE CHANGES



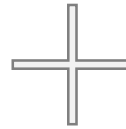
## EXTREMELY SLOW SCRAPER



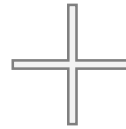
## SEMI-CLUNKY CODE



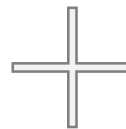
## IMPROVEMENTS



Add FX comparisons /  
access FX API



Run scraper daily at  
consistent times to  
capture changes in ticket  
prices



Get better at  python™

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