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| How to reliably predict airline delays | | |
| Shantel Culver | Tosin AdeboteAshley Drewry | Carolina PachecoMelissa Flores | Jiaxuan Ji | Sylvia Nanyangwe | | DS4A – Team 16 |

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**Team 16**

MEET the TEAM

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| OVERVIEW The airline industry provides air transportation for passengers and cargo by using aircraft. Flight delays and cancellations can significantly affect customer experience and cause financial loss to the business. The total cost of delays from 2016-2019 was over US$23 billion. Define the specific problem that should be solved Assist customers in making better decisions when booking flights and help businesses mitigate financial loss due to delays.   * Predict flights that will be delayed allowing passengers to avoid those flights if they chose. * Allow businesses to do root-cause analysis on flights with habitual delays as well as apply mitigation strategies to avoid negative customer experiences related to delays.   Figure 1 | |
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| The table above shows cost estimates of delays reported from the Federal Aviation Administrations in 2019  <https://www.faa.gov/data_research/aviation_data_statistics/media/cost_delay_estimates.pdf> | |  |

**How to accomplish this with data**

* Analyze flight delay data: detecting seasonality, airport and connection flights patterns and any correlation.

**Why does this problem matter?**

Delays have costs airlines over US$23 billion. Additionally, negative customer experiences further erode a company’s reputation and future profit by loss of business.

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| Potential Audience  * Anyone who is booking flight arrangements (for self or others) would be interested. This information would allow them to make informed decisions regarding flights and/or airports. * Airline executives could benefit by identifying frequently delayed flights and do deep dives into cause and effects.  |  |  |  | | --- | --- | --- | |  | Shape  Description automatically generated | Shape  Description automatically generated with low confidence | | Business  Airports, airlines, booking agents, any business profiting from the sale of air transportation. |  | Consumer  Business travelers, recreational travelers, frequent flyers, budget conscious individuals, etc. |   We believe our delay insights will be mutually  beneficial for the business as well as the consumer. | |

Flights

* November 25 has the MOST # of flights during 2018 (﻿22160)
* November 22 has the LEAST # of flights during 2018 (﻿12290)

Airlines

* Total airlines in 2018 = 18

Airports

* There are over 5000 airports in the USA
* The following are the busiest airports in the USA:

ATL

LAX

ORD

DFW

DEN

JFK

SFO

LAS

SEA

CLT

MCO

MIA

PHX

EWR

IAH

* Orlando International Airport (MCO) - 45M Passengers
* Miami International Airport (MIA) - 44M Passengers
* Phoenix Sky Harbor International Airport (PHX) – 44M Passengers
* Newark Liberty International Airport (EWR) – 43M Passengers
* George Bush Intercontinental Airport (IAH) – 41M Passengers

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| ABOUT THE DATASOURCESAirline Delay and Cancellation Data, 2009-2018  * US flights * Jan 2009-Dec 2018 * 6.43m for 2009, 6.45m for 2010, 6.07m for 2011, 6.10m for 2012, 6.37m 2013, 5.82m for 2014, 5.82m for 2015, 5.62m for 2016, 5.67m for 2017, 7.21m for 2018 * Has column for departure delay, a column where e 2% of entries have missing data for this variable * Has unique carrier code and the flight number. * Captures arrival and departure delays (with how long the delay was rather than a flag). * Link: <https://www.kaggle.com/yuanyuwendymu/airline-delay-and-cancellation-data-2009-2018>  January Flight Delay Prediction  * US flights * Jan 2019- Jan 2020 * 587k observation for 2019 and 607k for 2020 * Data is very complete * There is a flag column indicating it was delayed by 15 min or more. * This dataset has the unique carrier code and the flight number. * Captures arrival and departure delays (with how long the delay was rather than a flag). * Link: <https://www.kaggle.com/divyansh22/flight-delay-prediction>  Feb 2020 US Flight Delay  * US flights * Feb 2020 * 574k observations * Has a flag for departures that were more than 15 minutes late, but not how long the departure was. * Departure time and the departure delay flag are missing data for 1% of entries * Has unique carrier code but not the actual flight number. * Has 9 columns when the previous two datasets had 28 and 21, respectively. * Captures only departure delays, with a flag rather and not the duration of the delay. * Link: <https://www.kaggle.com/rowhitswami/feb-2020-us-flight-delay>   \*\* The original source for all data sets from Kaggle is the [Bureau of Transportation Statistics](https://www.bts.gov/). EDADATA WRANGLING AND CLEANINGOPERATIONALIZING THE VARIABLES  1. **What is the definition of a delay?**  * Per the [Federal Aviation Administration](https://www.faa.gov/), a flight is considered delayed when it is 15 minutes later than the scheduled time.  1. **What fields are we looking at to determine the delay?**  * The dataset we are using has 28 columns present. We are focusing on the DEP\_DELAY column which represents the number of minutes the flight is delayed beyond the scheduled departure time.    prepping the data Using the Panda’s built-in libraries, we performed the following items on our working dataset.   * Removed duplicate rows * Removed unnecessary data * Cancelled flight rows as we are not analyzing this portion of the dataset * Flights with a negative DEP\_DELAY value * Converted date and time columns to date/time variables * Added geopoints for the airports to use for mapping purposes   **Missing Values**  There are 18 columns with missing values. The number of missing values in these columns are close; this could  indicate they are in the same rows.  A picture containing text, air conditioner  Description automatically generated  White lines indicate missing values. Most of the missing values in those 18 columns are in the same rows. The rows with missing values might belong to *cancelled* or *diverted* flights. When looking at “CANCELLED” and “DIVERTED” columns, the number of cancelled flights is approximately the same as the number of missing values in columns about flight information.  Text  Description automatically generated  Text  Description automatically generated  Text  Description automatically generated  Diverted flights also cause missing values. The missing values are because of *cancelled* or *diverted* flights. Therefore, we decided to drop these columns.  Chart, histogram  Description automatically generated  Chart, bar chart  Description automatically generated  **Frequency distribution of delays:**  Chart  Description automatically generated  Chart, bar chart, histogram  Description automatically generated  Chart, histogram  Description automatically generated  \*There are over 5000 airports in the USA  \*Check Top 20 busiest airports  **Diverted & Cancelled Flights:**  Chart, bar chart, histogram  Description automatically generated  Preliminary graph analysis might indicate ‘cancelled’ and ‘diverted’ flights are the same; however, there are a total of 17,859 and 116,584 ‘diverted’ and ‘cancelled’ flights respectively.  Chart, bar chart  Description automatically generated  Diverted  0.0 7195587  1.0 17859  Chart, bar chart  Description automatically generated  Cancelled  0.0 7096862  1.0 116584  Boxplot of delays by airlines and airports  Chart, box and whisker chart  Description automatically generated  A picture containing box and whisker chart  Description automatically generated | |
| Dashboard 1 | |
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| exploratory data analysis Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Pellentesque id nibh tortor id aliquet. Purus in mollis nunc sed. Elit duis tristique sollicitudin nibh sit amet commodo nulla. At tellus at urna condimentum. Nunc non blandit massa enim nec dui nunc. Massa id neque aliquam vestibulum morbi blandit.  Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Nullam ac tortor vitae purus faucibus ornare suspendisse sed nisi. Adipiscing elit pellentesque habitant morbi tristique senectus et. Ultricies leo integer malesuada nunc vel.  Lorem ipsum dolor sit amet consectetur adipiscing. Nisi lacus sed viverra tellus. Orci eu lobortis elementum nibh tellus molestie nunc non. Laoreet suspendisse interdum consectetur libero id faucibus nisl tincidunt. Pharetra massa massa ultricies mi quis hendrerit dolor. Non tellus orci ac auctor augue mauris augue neque gravida. Nunc non blandit massa enim nec dui nunc mattis. Nulla malesuada pellentesque elit eget gravida cum. Sit amet nulla facilisi morbi | |
| |  |  |  |  | | --- | --- | --- | --- | |  | 2020 | 2021 | 2022 | | Labor | $50,000 | $60,000 | $75,000 | | Materials | $20,000 | $25,000 | $27,000 | | Research | $10,000 | $5,000 | $5,000 | | |
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