



Data Science Internship

# Individual Weekly Task Documentation

**Week #2:**

Foundations, Environment Setup,  
Data Analytics & AI Microservice with Flask

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## I. My Summarized Log

Encompasses five weekdays from Monday to Friday with 8-hours spent per day

**DAY 5**  
**Week 2**  
**Monday**  
**07/21/2025**

[08:00 AM - 11:00 AM]

- Read and studied the given task for Week 2 and created a plan for accomplishing all the tasks throughout the week
- Set up Notion for tracking and logging each accomplished task
- I watched the provided lecture videos about Big Data Analytics and Smart Supply Chain Technology

[11:00 AM - 12:00 PM]

- Break Time

[12:00 PM - 03:00 PM]

- Researched youtube video tutorials to be familiar with the following architectures and how to install and set up on my laptop
  - Laravel as backend
  - Next.js frontend
  - Flask for AI microservices
  - PostgreSQL as your database
  - Redis for job queueing
  - Metabase for analytics
  - Postman for testing

[12:00 PM - 03:00 PM]

- Continued with watching YouTube video tutorials

[03:00 PM - 05:00 PM]

- Started working on Individual Hands-on Tasks, that includes the installation, setting up and integration of each component of the architecture:
  1. Installation of PostgreSQL
  2. Creation of database
  3. Update of .env in Laravel
  4. Installation of PHP
  5. Installation of Laravel and creation of project
  6. Installation of Laravel Sanctum and Redis
  7. Creation of model and controller
  8. Migration
  9. API routing

**DAY 6**  
**Week 2**  
**Tuesday**  
**07/22/2025**

[08:00 AM - 11:00 AM]

- Continued the Individual Hands-on Task:
  1. Installation of Flask dependencies
  2. Creation of app.py
  3. Installation of Postman
  4. Creation of a POST request
  5. Creation of a Job through Laravel Queueing with Redis
  6. Dispatch of a job from controller
  7. Running Laravel queue worker
  8. Setting up Next.js for frontend
  9. Installation of Axios and SWR

[11:00 AM - 12:00 PM]

- Break Time

[12:00 PM – 03:30 PM]

- Testing whether the entire architecture so far are well-integrated or has working connections.
- Worked through errors found in the architecture's connections

[03:30 PM – 05:00 PM]

- Continued with the architecture
  1. Download Metabase Analytics Dashboard
  2. Connection to PostgreSQL
  3. Embedding into Next.js via iframe

**DAY 7**  
**Week 2**  
**Wednesday**  
**07/23/2025**

[08:00 AM - 10:00 AM]

- Conducted a self-review study on EDA processes and tools with Python Pandas, NumPy, Matplotlib

[10:00 AM - 11:00 AM]

- Searched for datasets online for EDA task

[11:00 AM - 12:00 PM]

- Break Time

[12:00 PM – 04:30 PM]

- Created a Jupyter Notebook for the EDA task
- Worked on the Data Cleaning and EDA of the Delhivery Dataset found in Kaggle
- Created simple analysis and visualizations
  - Route Type Distribution
  - Average segment\_actual\_time vs. segment\_osrm\_time
  - Actual vs Predicted Delivery Time
  - Top 10 Sources and Top 10 Destinations
  - Trip Created by Months

[04:30 PM – 05:00 PM]

- Created document format for Individual Weekly Task Documentation

**DAY 8**  
**Week 2**  
**Thursday**  
**07/24/2025**

[08:00 AM - 10:00 AM]

- Selected a new dataset from the one recently provided by Ms. April
- Created a new Jupyter Notebook for Data Cleaning and EDA of new dataset

[10:00 AM - 11:00 PM]

- Conducted Data Cleaning on the Driver Behavior dataset

[11:00 PM – 12:00 PM]

- Break Time

[12:00 PM – 02:30 PM]

- Worked on EDA of the Driver Behavior Dataset provided by Ms. April

[02:30 PM – 05:30 PM]

- Conducted analysis and visualizations:
  - Distribution of Key Numeric Variables (Speed, Acceleration, RPM)
  - Distribution of Key Categorical Variables (Weather, Road Type, Traffic Condition)
  - Driver Comparison based on Average Speed, Fuel Usage, and Lane Deviation)
  - Trip Frequency per Hour
  - Trip Duration by Traffic Condition
  - Fuel Consumption by Road Type
  - Brake usage by Weather Condition
  - Anomaly Frequency

**DAY 9**  
**Week 2**  
**Friday**  
**07/25/2025**

[08:00 AM - 09:00 AM]

- Started on the Individual Weekly Task Documentation

[09:00 AM - 10:00 PM]

- Early break

[10:00 PM – 02:00 PM]

- Collected all the screensnaps showing how I worked on the Individual Hands-on task and created a report for how I conducted each step.

[02:00 PM – 02:30 PM]

- Afternoon break

[02:30 PM – 05:00 PM]

- Continued working on the Individual Weekly Task Documentation
- Worked on creating a report for the Data Cleaning and EDA Task
- Collected all the links to lecture videos I watched
- Collected all the links to the deliverables
- Organized all the deliverable files
- Submit all the deliverables to the drive folder.

## II. Lecture Report and Team Progress Report

### Lectures Watched

- [Big Data Analytics for Smart Logistics](#),
- [What Data Do Smart Supply Chain Technology Systems Use?](#)
- [Laravel in 100 Seconds](#)
- [Next.js in 100 Seconds // Plus Full Beginner's Tutorial](#)
- [A brilliant introduction to Flask](#)
- [Build a Rest API using Flask](#)
- [PostgreSQL in 100 Seconds](#)
- [What is Metabase?](#)
- [Installing Metabase](#)
- [Postman API Testing Tutorial](#)
- [Redis in 100 Seconds](#)

Watching these videos helped me understand every part of the system I'm building. The logistics videos made it clear to me what kind of data I need to collect and why it matters for things like delivery time predictions. The Laravel, Next.js, Flask, and PostgreSQL videos showed me how to build and connect each part of my app from the backend to the frontend to AI services. Metabase helped me understand the importance of seeing the data clearly through dashboards, and Postman makes it easier to test my APIs. Although brief, these videos give me the knowledge I need to build the architecture

### Team Progress

- The team conducted a team meeting prior to the meeting with the other team.
- Sections and sub teams were formed to distribute the tasks.

### Sections and Subteams

Task	Assigned
Admin View	James, Nathaniel
Insights	Jima, Lloyd
Logistics Provider View	Hans, Daniel, Kief
Driver Performance Analysis	Glax, Evan, Kharl
Predictive Route Estimation	Syke, Paul, Kurt
Smart Logistics Recommendation	Keith, Catherine, Angela

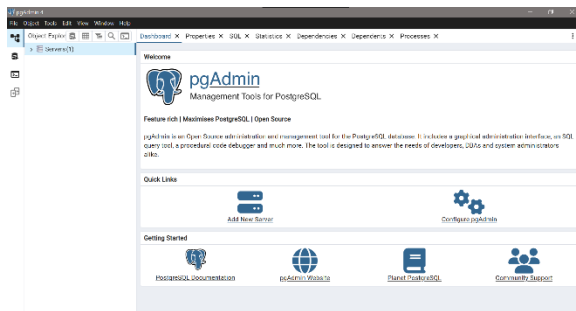
- Tasks and Deliverables were established:
  1. Analytics Module (Thumbworx 2.0)
    - Phase 1 (Operational Analytics)
      - Admin View
      - Logistic Provider View
    - Phase 2 (Insights and Trends)
      - Driver Performance
      - Support Issues
      - Active Delivery Days/Times
      - Client Drop Off Location Frequency
      - Average Delivery Time Per Route
  2. AI/ML Upload
    - Predictive Route Estimation
    - Driver Performance Analysis
    - Smart Logistics Recommendations

### III. Individual Hands-on Activity

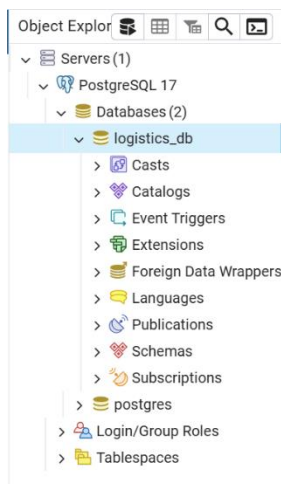
- Architecture
- Laravel as backend
- Next.js frontend
- Flask for AI microservices
- PostgreSQL as your database
- Redis for job queueing
- Metabase for analytics
- Postman for testing
- A sample Machine Learning model for delivery time prediction

#### PART 1: Setup PostgreSQL

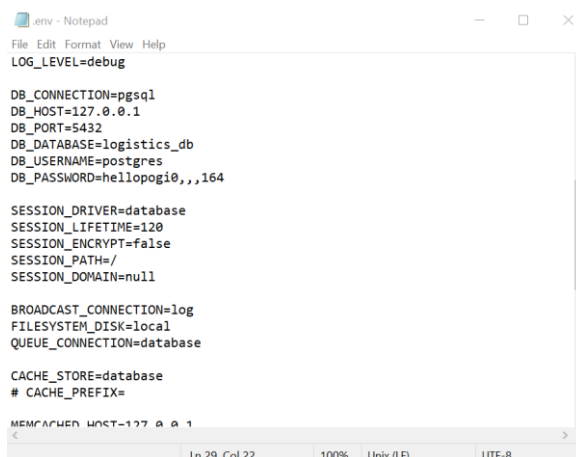
- Install PostgreSQL



- Create database



- Update .env in Laravel



## PART 2: Laravel Backend Setup

- Install PHP

```
Command Prompt
Microsoft Windows [Version 10.0.19045.6093]
(c) Microsoft Corporation. All rights reserved.

C:\Users\jimal>php --version
PHP 8.3.21 (cli) (built: May 6 2025 15:56:17) (NTS Visual C++ 2019 x64)
Copyright (c) The PHP Group
Zend Engine v4.3.21, Copyright (c) Zend Technologies

C:\Users\jimal>
```

- Install Composer

```
Command Prompt
Microsoft Windows [Version 10.0.19045.6093]
(c) Microsoft Corporation. All rights reserved.

C:\Users\jimal>composer

Composer version 2.8.10 2025-07-10 19:08:33

Usage:
  command [options] [arguments]

Options:
  -h, --help                Display help for the given command. When no command is given display help for the list
  -q, --quiet               Do not output any message
  -V, --version              Display this application version
  --ansi|--no-ansi          Force (or disable --no-ansi) ANSI output
  -n, --no-interaction       Do not ask any interactive question
  --profile                 Display timing and memory usage information
  --no-plugins              Whether to disable plugins
  --no-scripts              Skips the execution of all scripts defined in composer.json file.
  -d, --working-dir=WORKING-DIR If specified, use the given directory as working directory.
  --cache                   Prevent use of the cache
  -v|vv|vvv, --verbose      Increase the verbosity of messages: 1 for normal output, 2 for more verbose output and
                             3 for debug
```

- Install Laravel and Create Laravel Project

```
Command Prompt > composer create-project laravel/laravel backend
C:\Users\jimal>composer create-project laravel/laravel backend
Creating a 'laravel/laravel' project at 'backend'
Installing laravel/laravel (v12.1.0)
  -> Installing laravel/laravel (v12.1.0): Extracting archive
Created project in C:\Users\jimal\backend
> @php -r "file_exists('.env') || copy('.env.example', '.env');"
Adding composer repositories with package information
Updating dependencies
Lock file operations: 50 installs, 0 updates, 0 removals
  - Locking brick/math (0.13.1)
  - Locking carbonphp/carbon-doctrine-types (3.2.0)
  - Locking doctrine/dbal (4.0.0)
  - Locking doctrine/inflector (2.0.10)
  - Locking doctrine/lexer (3.0.1)
  - Locking dragonmantec/composer-require-laravel (3.4.0)
  - Locking egulias/email-validator (4.0.4)
  - Locking fakerphp/faker (v1.24.1)
  - Locking filp/whoops (2.18.3)
  - Locking fruitcake/php-cors (v1.3.0)
  - Locking graham-campbell/result-type (v1.1.3)
  - Locking guzzlehttp/guzzle (7.9.1)
  - Locking guzzlehttp/promises (2.2.0)
  - Locking guzzlehttp/psr7 (2.7.1)
  - Locking guzzlehttp/uri-template (v1.0.4)
  - Locking hamcrest/hamcrest-php (v2.1.1)
  - Locking illuminate/foundation (v12.20.0)
  - Locking illuminate/http (v12.20.0)
  - Locking illuminate/routing (v12.20.0)
  - Locking illuminate/view (v12.20.0)
  - Locking laravel/pail (v1.2.3)
  - Locking laravel/pint (v1.24.0)
  - Locking laravel/sanctum (v4.0.3)
```

- Install Laravel Sanctum for API auth and Redis for queues

```
Command Prompt
C:\Users\jimal>composer require laravel/sanctum
./composer.json has been updated
Running composer update laravel/sanctum
Adding composer repositories with package information
Updating dependencies
Lock file operations: 1 install, 0 updates, 0 removals
  - Locking laravel/sanctum (v4.1.2)
Writing lock file
Installing dependencies from lock file (including require-dev)
Package operations: 1 install, 0 updates, 0 removals
  -> Installing laravel/sanctum (v4.1.2): Extracting archive
Generating optimized autoload files
> illuminate/Foundation/ComposerScripts::postAutoloadDump
> @php artisan package:discover --ansi
INFO: Discovering packages.
laravel/pail ..... DONE
laravel/sail ..... DONE
laravel/sanctum ..... DONE
laravel/tinker ..... DONE
nesbot/carbon ..... DONE
nunomaduro/collision ..... DONE
nunomaduro/termwind ..... DONE

If packages you are using are looking for funding,
see the 'composer fund' command to find out more!
> @php artisan vendor:publish --tag=laravel-assets --ansi --force
```

```
C:\Users\jimal\backend>php artisan vendor:publish --provider="Laravel\Sanctum\SanctumServiceProvider"
INFO: Publishing assets.
Copying directory [C:\Users\jimal\backend\vendor\laravel\sanctum\database\Migrations] to [C:\Users\jimal\backend\database\Migrations] DONE
Copying file [C:\Users\jimal\backend\vendor\laravel\sanctum\config\sanctum.php] to [C:\Users\jimal\backend\config\sanctum.php] DONE
```

```
Command Prompt
C:\Users\jimal\backend>php artisan migrate
INFO: Preparing database.
Creating migration table ..... 10.30ms DONE
INFO: Running migrations.
0001_01_01_000000_create_users_table ..... 24.54ms DONE
0001_01_01_000001_create_cache_table ..... 8.86ms DONE
0001_01_01_000002_create_jobs_table ..... 19.84ms DONE
2025_07_21_031129_create_personal_access_tokens_table ..... 10.86ms DONE

C:\Users\jimal\backend>php artisan vendor:publish --provider="Laravel\Sanctum\SanctumServiceProvider"
INFO: Publishing assets.
Copying directory [C:\Users\jimal\backend\vendor\laravel\sanctum\database\Migrations] to [C:\Users\jimal\backend\database\Migrations] DONE
File [C:\Users\jimal\backend\config\sanctum.php] already exists ..... SKIPPED
```



```
Command Prompt
C:\Users\jimal\backend>php artisan migrate
INFO: Running migrations.
2025_07_21_040901_create_personal_access_tokens_table ..... 26.7ms DONE

Command Prompt
C:\Users\jimal\backend>composer require predis/predis
Composer lock has been updated.
Loading composer repositories with package information
Updating dependencies
Nothing to modify in lock file
Writing lock file
Installing dependencies from lock file (including require-dev)
Nothing to install, update or remove
Generating optimized autoload files
 illuminate/Foundation/ComposerScripts::postAutoloadDump
 php artisan package:discover --ansi
INFO: Discovering packages.
laravel/pail ..... DONE
laravel/pail ..... DONE
laravel/sanctum ..... DONE
laravel/tinker ..... DONE
nesbot/carbon ..... DONE
nunomaduro/collision ..... DONE
nunomaduro/termwind ..... DONE
0 packages you are using are looking for funding.
see the composer fund command for fund and receive
php artisan vendor:publish --tag=laravel-assets --ansi --force
INFO: No publishable resources for tag [laravel-assets].
```

- Create a model & controller for delivery

```
Command Prompt
C:\Users\jimal\backend>php artisan make:model Delivery -m
INFO: Model [C:\Users\jimal\backend\app\Models\Delivery.php] created successfully.
INFO: Migration [C:\Users\jimal\backend\database\Migrations\2025_07_21_041908_create_deliveries_table.php] created successfully.
C:\Users\jimal\backend>php artisan make:controller DeliveryController
INFO: Controller [C:\Users\jimal\backend\app\Http\Controllers\DeliveryController.php] created successfully.
```

- Migration

```
File Edit Selection View Go Run Terminal Help 2025_07_21_041908_create_deliveries_table.php - Visual Studio Code
2025_07_21_041908_create_deliveries_table.php X
C:\Users\jimal\backend>database>migrations> 2025_07_21_041908_create_deliveries_table.php
1 <?php
2
3 use Illuminate\Database\Migrations\Migration;
4 use Illuminate\Database\Schema\Blueprint;
5 use Illuminate\Support\Facades\Schema;
6
7 return new class extends Migration
8 {
9     /**
10      * Run the migrations.
11      */
12     public function up(): void
13     {
14         Schema::create('deliveries', function (Blueprint $table) {
15             $table->id();
16             $table->string('location');
17             $table->integer('distance km');
18             $table->float('fuel used');
19             $table->integer('time_minutes')>nullable(); // for prediction
20             $table->timestamp();
21         });
22     }
23
24     /**
25      * Reverse the migrations.
26      */
27     public function down(): void
28     {
29         Schema::dropIfExists('deliveries');
30     }
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## PART 3: Flask Microservice with ML Model

- Install dependencies

[illegible]

- [app.py](#)

```

1  # Import modules
2  import redis
3  from rq import Queue
4  import numpy as np
5
6  app = Flask(__name__)
7  (conn)
8
9  # Redis queue
10 r = redis.Redis()
11 q = Queue(connection=r)
12
13 # Dummy fit model (linear regression)
14
15 def train_model():
16     from sklearn.linear_model import LinearRegression
17     import numpy as np
18
19     X = np.array([[1, 1], [2, 2], [3, 1.5], [4, 3]])
20     y = np.array([10, 20, 22, 50])
21     model = LinearRegression().fit(X, y)
22     joblib.dump(model, 'model.pkl')
23
24
25 @app.route('/predict', methods=['POST'])
26 def predict():
27     data = request.json
28     x = [data['distance_km'], data['eta_used']]
29
30     model = joblib.load('model.pkl')
31     prediction = model.predict(X)[0]
32     return jsonify({'eta_minutes': round(prediction, 2)})
33
34
35 if __name__ == '__main__':
36     train_model() # Only once
37     app.run(port=5000)

```

## PART 4: Test flask API with Postman

- POST Request

[illegible]

## PART 5: Laravel Queueing with Redis

- Create a Job

```

spring:
  main-class: com.example.demo.DemoApplication
  jmx.enabled: true

server:
  port: 8080
  servlet-context-path: /demo
  
```

- Dispatch job from controller

```

1  <?php
2  namespace App\Http\Controllers;
3  use Illuminate\Http\Request;
4
5  class DeliveryController extends Controller
6  {
7      public function predict(Request $request)
8      {
9          $data = $request->only('distance_km', 'fuel_used');
10         $response = http::post('http://127.0.0.1:3000/predict', $data);
11         PredictDeliveryTime::dispatch($delivery);
12
13         return response()->json([
14             'predicted_time' => $response->json()['eta_minutes'],
15         ]);
16     }
17 }

```

- Run Laravel queue worker

## PART 6: Next.js Frontend Integration

- Install Axios & SWR

```

1  export default function PredictPage() {
2      const [distance, setDistance] = useState(0);
3      const [fuelUsed, setFuelUsed] = useState(0);
4      const [predictedTime, setPredictedTime] = useState('');
5      const [loading, setLoading] = useState(false);
6
7      const handleSubmit = async (e) => {
8          e.preventDefault();
9          setLoading(true);
10         try {
11             const response = await axios.post('http://127.0.0.1:3000/predict', {
12                 distance: distance,
13                 fuelUsed: fuelUsed,
14             });
15             setPredictedTime(response.data.predicted_time);
16         } catch (error) {
17             console.error(error);
18         }
19         setLoading(false);
20     };
21
22     return (
23         <div>
24             <input type="text" value={distance} onChange={e => setDistance(e.target.value)} />
25             <input type="text" value={fuelUsed} onChange={e => setFuelUsed(e.target.value)} />
26             <button onClick={handleSubmit}>Predict</button>
27             {loading ? <div>Loading...</div> : <div>Estimated time: {predictedTime}</div>}
28         </div>
29     );
30 }

```

```

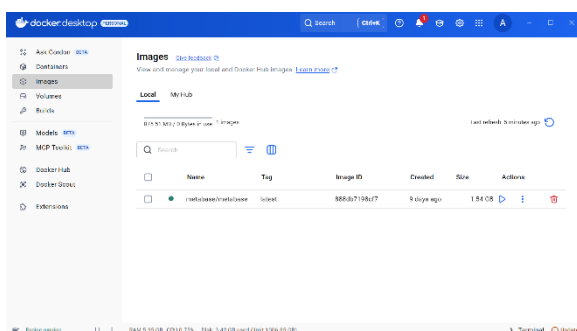
PS C:\Users\jimal\frontend> npm install axios swr
added 27 packages in 6s
6 packages are looking for funding
run `npm fund` for details
npm notice
npm notice New major version of npm available! 10.9.2 -> 11.4.2
npm notice Changelog: https://github.com/npm/cli/releases/tag/v11.4.2
npm notice To update run: npm install -g npm@11.4.2
npm notice

```

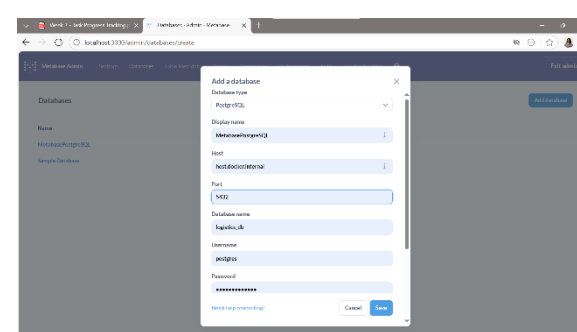
- Check Integration

## PART 7: Metabase Analytics Dashboard

- Download Metabase: <https://www.metabase.com/start/oss/>



- Connect to PostgreSQL:



#### Observations and Errors Encountered:

1. The frontend would run on `npm run dev` but webpage shows error
2. laravel works on php artisan serve
3. flask would run on python `app.py` but webpage shows error
4. testing POST for `localhost/predict` works on POSTMAN
5. testing POST for `localhost/predict-delivery` does not work despite controllers, `app.py`, api routing are properly configured

Because of this, I still have yet to build the dashboards and embed the dashboards into Next.js via iframe.

## IV. Data Cleaning and EDA on Delhivery Dataset

I started on this activity earlier assuming that the search for a dataset is our responsibility. Later on during the week, we were provided with links of datasets to select from. I have two outputs for the activity because I wanted to show the process on the Delhivery Dataset too as I believe it has relevance to the study we are conducting, and I learned a lot of things from it too.

The Data Cleaning and EDA process of both datasets were conducted in Google Colab. I used the same group of python libraries for both analyses. Pandas for handling dataframes and transforming the dataset. NumPy for statistical functions. And, Matplotlib and Seaborn for the different visualizations.

First dataset:

[https://colab.research.google.com/drive/1HvvmXJMHKtaG0MIQILwDMWFYz5MCVVqq?usp=drive\\_link](https://colab.research.google.com/drive/1HvvmXJMHKtaG0MIQILwDMWFYz5MCVVqq?usp=drive_link)

The basic data cleaning processes I conducted are:

- Dropping null rows
- Dropping unnecessary and redundant columns
- Converting to appropriate data types

```
Delhivery-Dataset
File Edit View Insert Runtime Tools Help
Python 3.8.10
Data Cleaning and Exploratory Data Analysis on Delhivery Dataset
by Aniket D. Joshi
Kaggle Link: https://www.kaggle.com/datasets/aniketdjos/delhivery-dataset

Loading dataset

import kaggleapi
import os

# Download latest version
path = kaggleapi.dataset_download("aniketdjos/delhivery-dataset")

# Downloading file
url = "https://www.kaggle.com/datasets/aniketdjos/delhivery-dataset/version/1/files"
path = kaggleapi.dataset_download(path)

!cp {path} /content/delhivery-dataset

!ls -l /content/delhivery-dataset

!cat /content/delhivery-dataset/delhivery-dataset/versions/1

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!cat /content/delhivery-dataset/delhivery-dataset/versions/1

Initial dataset exploration for cleaning

import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

delhivery_data = pd.read_csv(os.path.join(path, "delhivery_data.csv"))

delhivery_data.head()

data_trip_creation_time route_schedule_uid route_type trip_uid source_center source_name destination_center destination_name od_start_time ... cutoff_timestamp actual_distance_to_destination actual_time osrm_time osrm_distance factor segment_actual_time segment_osrm_time
0 2018-09-30 02:35:36-075840 153701039476492020 Catreg 153701039476492020 Anand_Viharige_JC (Gurgaon) 153701039476492020 Ramesh_MonuDPE_JC (Gurgaon) 2018-09-30 03:21:32-075840 2018-09-30 04:27:55 10435660 14.0 11.0 11.9633 1.272727 14.0 11.0
1 2018-09-30 02:35:36-075840 153701039476492020 Catreg 153701039476492020 Anand_Viharige_JC (Gurgaon) 153701039476492020 Ramesh_MonuDPE_JC (Gurgaon) 2018-09-30 03:21:32-075840 2018-09-30 04:27:55 10435660 28.0 22.0 21.7242 1.200000 18.0 9.0
2 2018-09-30 02:35:36-075840 153701039476492020 Catreg 153701039476492020 Anand_Viharige_JC (Gurgaon) 153701039476492020 Ramesh_MonuDPE_JC (Gurgaon) 2018-09-30 03:21:32-075840 2018-09-30 04:27:55 10435660 27.037279 48.0 28.0 32.0391 1.420371 14.0 7.0

df.info()

<class 'pandas.core.frame.DataFrame'>
Int64Index: 144316 entries, 0 to 144866
Data columns (total 24 columns):
 #   Column                                Non-Null Count  Dtype
---  ---
 0   data                                  144316 non-null object
 1   trip_creation_time                    144316 non-null object
 2   route_schedule_uid                    144316 non-null object
 3   route_type                            144316 non-null object
 4   trip_uid                              144316 non-null object
 5   source_center                         144316 non-null object
 6   source_name                           144316 non-null object
 7   destination_center                    144316 non-null object
 8   destination_name                       144316 non-null object
 9   od_start_time                         144316 non-null object
10   od_end_time                           144316 non-null object
11   start_scan_to_end_scan                 144316 non-null float64
12   is_cutoff                              144316 non-null bool
13   cutoff_factor                          144316 non-null int64
14   cutoff_timestamp                       144316 non-null object
15   actual_distance_to_destination           144316 non-null float64
16   actual_time                            144316 non-null float64
17   osrm_time                              144316 non-null float64
18   osrm_distance                          144316 non-null float64
19   factor                                 144316 non-null float64
20   segment_actual_time                    144316 non-null float64
21   segment_osrm_time                      144316 non-null float64
22   segment_osrm_distance                   144316 non-null float64
23   segment_factor                          144316 non-null float64
dtypes: bool(1), float64(10), int64(1), object(12)
memory usage: 35.6+ MB

# Convert date columns to date_time data type
date_columns = ["trip_creation_time",
                 "od_start_time",
                 "od_end_time",
                 "cutoff_timestamp"]

for col in date_columns:
    df[col] = pd.to_datetime(df[col], format='mixed')

# Drop redundant columns (e.g. ID for a given route name)
redundant_columns = ["route_schedule_uid",
                     "trip_uid",
                     "source_center",
                     "destination_center"]

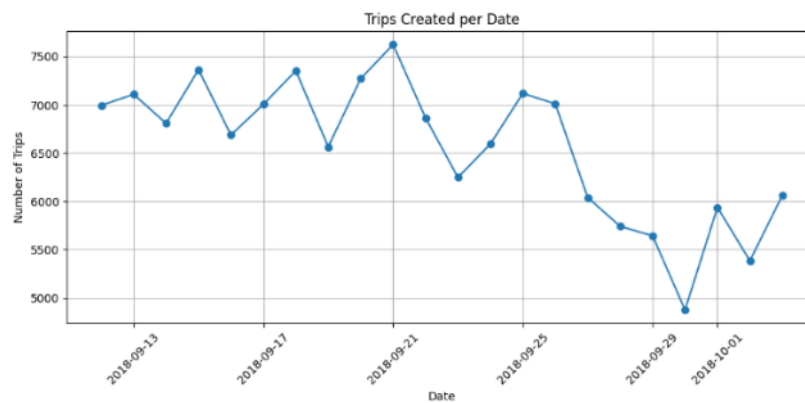
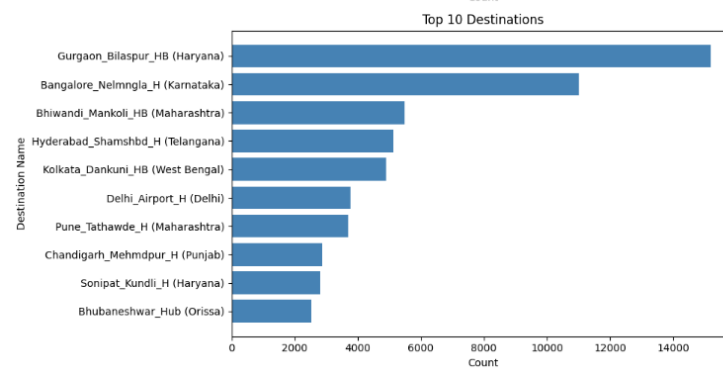
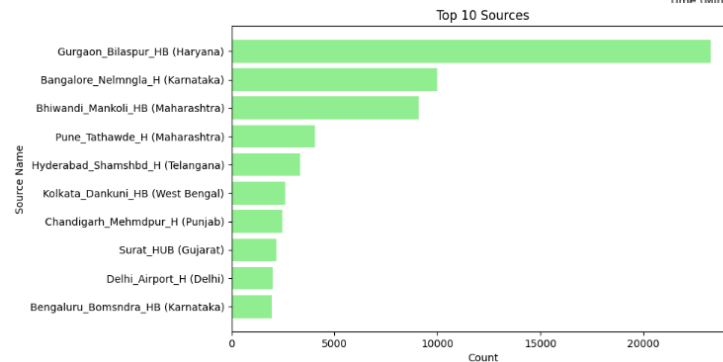
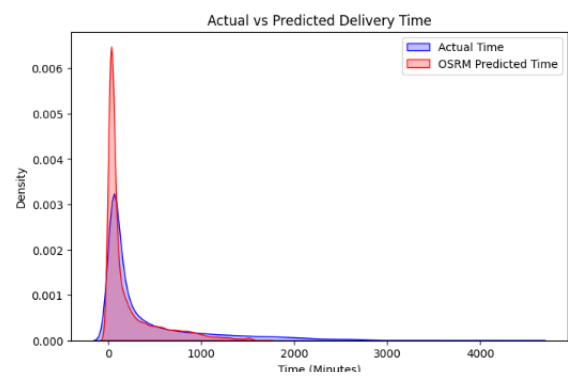
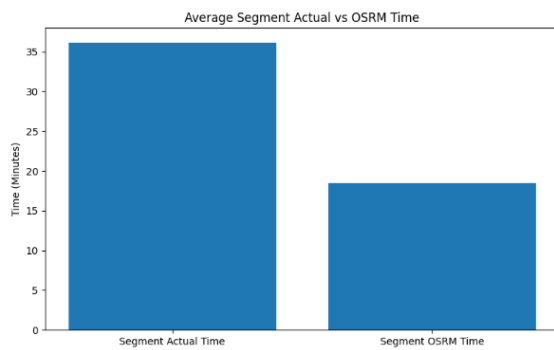
df = df.drop(columns=redundant_columns)

# Drop columns whose meaning is unknown according to the kaggle source
unknown_columns = ["data",
                   "is_cutoff",
                   "cutoff_factor",
                   "cutoff_timestamp",
                   "factor",
                   "segment_factor"]

df = df.drop(columns=unknown_columns)
```

The basic data analysis and visualization tasks conducted are:

- Statistical description of the numerical columns (count, mean, ave, min, max, etc)
- Route Type Distribution
- Average segment\_actual\_time vs. segment\_osrm\_time
- Actual vs Predicted Delivery Time
- Top 10 Sources and Top 10 Destinations
- Trip Created by Months



## V. Data Cleaning and EDA on Driver Behavior Dataset

Second dataset:

[https://colab.research.google.com/drive/1nJlVVogWuLsqscGGeQt24irP09ifbaYn?usp=drive\\_link](https://colab.research.google.com/drive/1nJlVVogWuLsqscGGeQt24irP09ifbaYn?usp=drive_link)

The dataset is already in good formatting. The only data cleaning step it required was the conversion of columns to appropriate data types for analysis.

```
Driver Behavior.ipynb
File Edit View Insert Runtime Tools Help
Commands Code Text Run all
Data Cleaning and Exploratory Data Analysis on Driver Behavior Dataset
By J. Malin Del Rosario
Kaggle link: https://www.kaggle.com/datasets/datasongroboter/driver-behavior-and-route-anomaly-dataset-drsq4
Loading dataset
[ ] Import kagglehub
import os
# download latest version
path = kagglehub.dataset_download("datasongroboter/driver-behavior-and-route-anomaly-dataset-drsq4")
[ ] path
'/kaggle/input/driver-behavior-and-route-anomaly-dataset-drsq4'
[ ] os.listdir(path)
['driver_behavior_route_anomaly_dataset_with_derived_features.csv']
Initial dataset exploration for cleaning
[ ] Import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
[ ] driver_behavior = pd.read_csv(os.path.join(path, "driver_behavior_route_anomaly_dataset_with_derived_features.csv"))
[ ] driver_behavior.head()
  trip_id  driver_id  vehicle_id  timestamp  latitude  longitude  speed  acceleration  steering_angle  heading  ...  weather_conditions  road_type  traffic_condition  stop_events  geofencing_violation  anomalous_event  route_anomaly  route_deviation_score  acceleration_variation  behavioral_consistency_index
0      1      101      1001      2023-01-01 36.916143 -80.345269 35.454646  3.612832          -21  134.541146  ...      Sunny      Urban      Light      0      0      0      0      0.176974      0.715284      0.46618
1      2      105      2002      2023-01-01 37.011830 -89.076516 1.795422 -0.593205          -21  134.541146  ...      Sunny      Highway      Light      0      0      0      0      0.229316      0.487761      0.23493
2      3      103      2002      2023-01-01 33.784009 -96.103643 13.842558 -0.209264          26  116.452839  ...      Cloudy      Urban      Moderate  0      0      0      0      0.473809      0.881141      0.19258
3      4      102      2002      2023-01-01 45.314835 -102.046210 89.121833 -0.413943          6   26.970247  ...      Sunny      Highway      Moderate  3      0      0      0      0.368063      0.937918      0.36370
```

### Converting to appropriate data types

```
[ ] df['timestamp'] = pd.to_datetime(df['timestamp'], dayfirst=True)

[ ] cat_columns = ["driver_id",
                  "vehicle_id",
                  "weather_conditions",
                  "road_type",
                  "traffic_condition",
                  "geofencing_violation",
                  "anomalous_event",
                  "route_anomaly"]
df[cat_columns] = df[cat_columns].astype("category")
```

### Dropping unnecessary or redundant columns

```
cols_to_drop = ["trip_id",
                "latitude",
                "longitude",
                "heading"]

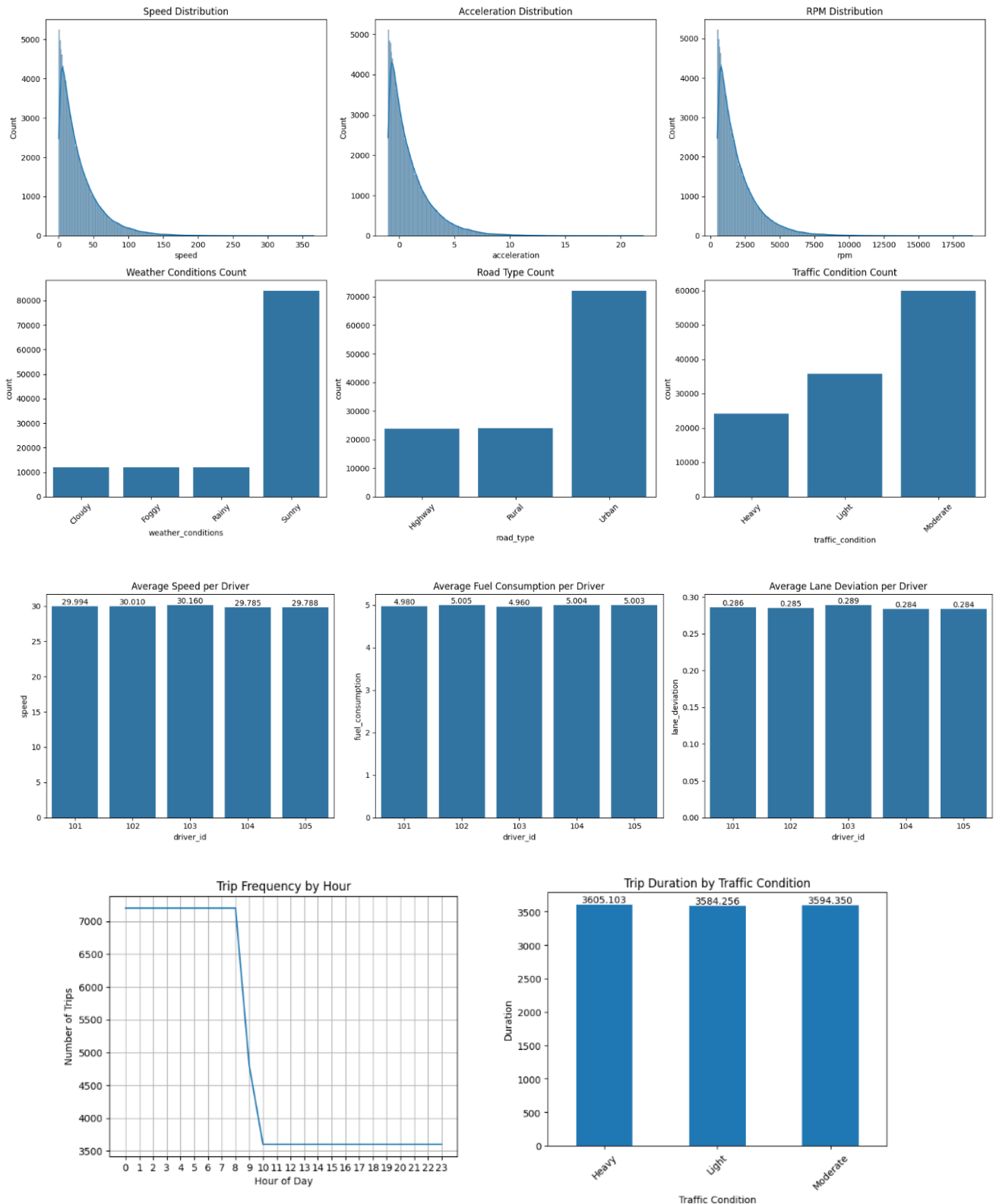
df = df.drop(columns=cols_to_drop)

[ ] df.info()

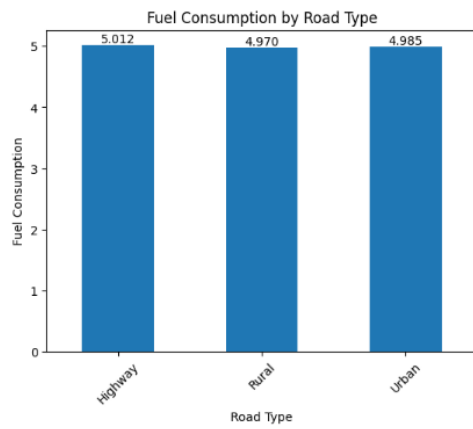
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 120000 entries, 0 to 119999
Data columns (total 22 columns):
 #   Column                                Non-Null Count  Dtype
---  -
 0   driver_id                            120000 non-null  category
 1   vehicle_id                           120000 non-null  category
 2   timestamp                            120000 non-null  datetime64[ns]
 3   speed                               120000 non-null  float64
 4   acceleration                         120000 non-null  float64
 5   steering_angle                       120000 non-null  int64
 6   trip_duration                        120000 non-null  float64
 7   trip_distance                        120000 non-null  float64
 8   fuel_consumption                     120000 non-null  float64
 9   rpm                                  120000 non-null  float64
10  brake_usage                          120000 non-null  int64
11  lane_deviation                       120000 non-null  float64
12  weather_conditions                   120000 non-null  category
13  road_type                           120000 non-null  category
14  traffic_condition                    120000 non-null  category
15  stop_events                          120000 non-null  int64
16  geofencing_violation                 120000 non-null  category
17  anomalous_event                      120000 non-null  category
18  route_anomaly                       120000 non-null  category
19  route_deviation_score                120000 non-null  float64
20  acceleration_variation                120000 non-null  float64
21  behavioral_consistency_index          120000 non-null  float64
dtypes: category(8), datetime64[ns](1), float64(10), int64(3)
memory usage: 13.7 MB
```

## Data analysis and visualizations:

- Distribution of Key Numeric Variables (Speed, Acceleration, RPM)
- Distribution of Key Categorical Variables (Weather, Road Type, Traffic Condition)
- Driver Comparison based on Average Speed, Fuel Usage, and Lane Deviation)
- Trip Frequency per Hour
- Trip Duration by Traffic Condition
- Fuel Consumption by Road Type
- Brake usage by Weather Condition
- Anomaly Frequency







▼ Anomaly Frequency

```
df[['anomalous_event', 'route_anomaly', 'geofencing_violation']].astype(int).sum()
```



	0
anomalous_event	12020
route_anomaly	11965
geofencing_violation	6029

dtype: int64

