



IBM Developer SKILLS NETWORK

Build a Dashboard Application with Plotly Dash

In this lab, you will be building a Plotly Dash application for users to perform interactive visual analytics on SpaceX launch data in real-time.

This dashboard application contains input components such as a dropdown list and a range slider to interact with a pie chart and a scatter point chart. You will be guided to build this dashboard application via the following tasks:

- TASK 1: Add a Launch Site Drop-down Input Component
- TASK 2: Add a callback function to render `success-pie-chart` based on selected site dropdown
- TASK 3: Add a Range Slider to Select Payload
- TASK 4: Add a callback function to render the `success-payload-scatter-chart` scatter plot

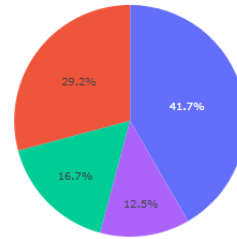
Your completed dashboard application should look like the following screenshot:

SpaceX Launch Records Dashboard

All Sites

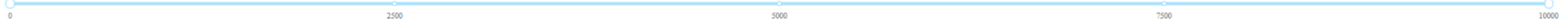
X

Total Success Launches By Site

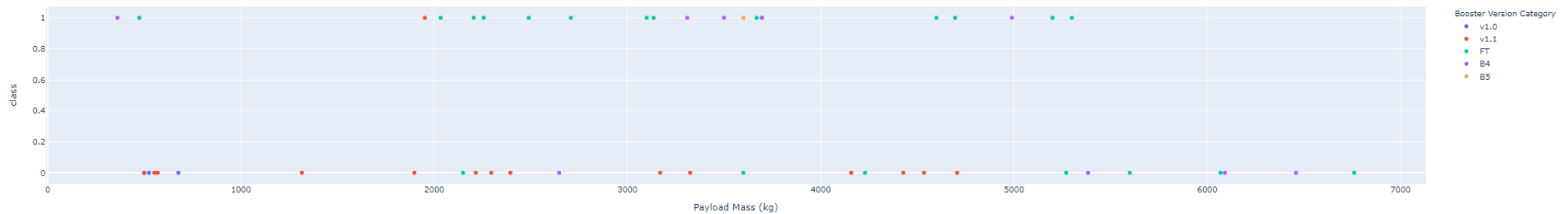


KSC LC-39A
CCAFS LC-40
VAFB SLC-4E
CCAFS SLC-40

Payload range (Kg):



Correlation between Payload and Success for all Sites



After visual analysis using the dashboard, you should be able to obtain some insights to answer the following five questions:

1. Which site has the largest successful launches?
2. Which site has the highest launch success rate?
3. Which payload range(s) has the highest launch success rate?
4. Which payload range(s) has the lowest launch success rate?
5. Which F9 Booster version (**v1.0**, **v1.1**, **FT**, **B4**, **B5**, etc.) has the highest

launch success rate?

Estimated time needed: 90 minutes

Important Notice about this lab environment

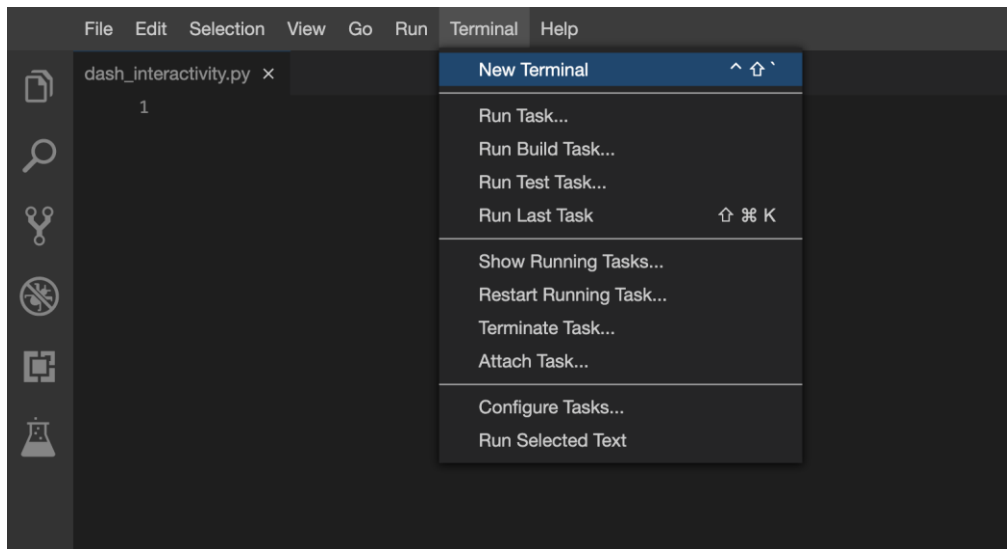
Please be aware that sessions for this lab environment are not persisted. When you launch the Cloud IDE, you are presented with a 'dedicated computer on the cloud' exclusively for you. This is available to you as long as you are actively working on the labs. Once you close your session or it is timed out due to inactivity, you are logged off, and this **dedicated computer on the cloud** is deleted along with any files you may have created, downloaded or installed.

The next time you launch this lab, a new environment is created for you. If you finish only part of the lab and return later, you may have to start from the beginning. So, it is a good idea to plan your time accordingly and finish your labs in a single session.

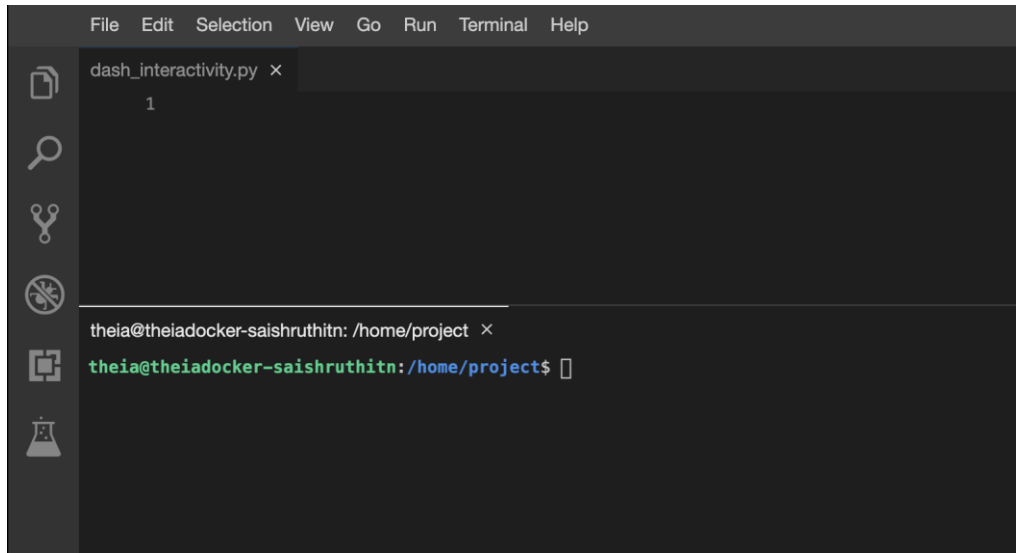
Setup development environment

Install required Python packages

- Open a new terminal, by clicking on the menu bar and selecting **Terminal->New Terminal**, as in the image below.



- Now, you have script and terminal ready to start the lab.

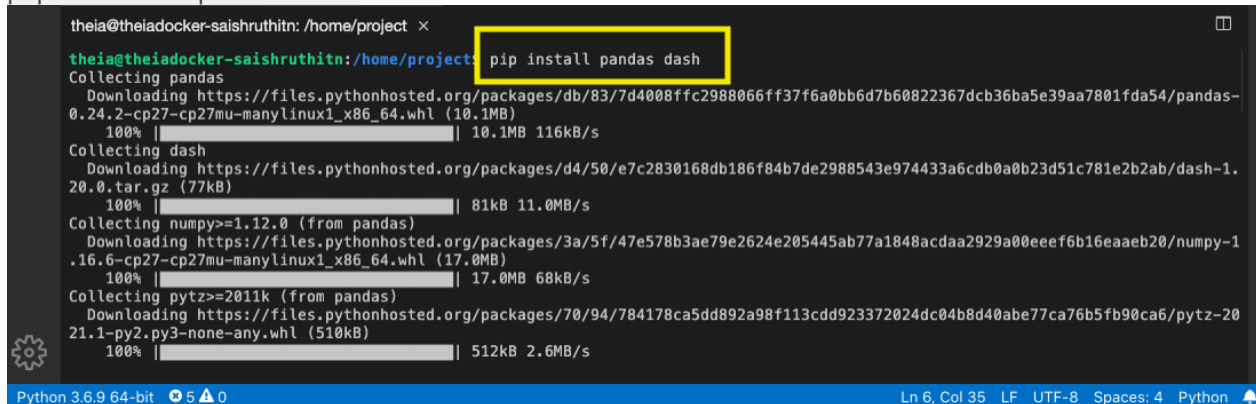


The screenshot shows a code editor with a menu bar (File, Edit, Selection, View, Go, Run, Terminal, Help) and a sidebar with icons for file management, search, and other tools. The main editor area shows a file named `dash_interactivity.py` with a single line of code: `1`. Below the editor is a terminal window with the prompt `theia@theiadocker-saishruthitn: /home/project` and a command prompt `theia@theiadocker-saishruthitn: /home/project$`.

- Install python packages required to run the application.

Copy and paste the below command to the terminal.

```
pip3 install pandas dash
```



The screenshot shows a terminal window with the command `pip3 install pandas dash` being executed. The command is highlighted with a yellow box. The output shows the installation progress for pandas, dash, numpy, and pytz. The status bar at the bottom indicates Python 3.6.9 64-bit, 5 errors, and 0 warnings.

Download a skeleton dashboard application and dataset

First, let's get the SpaceX Launch dataset for this lab:

- Run the following `wget` command line in the terminal to download dataset as `spacex_launch_dash.csv`

```
wget "https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DS0321EN-SkillsNetwork/datasets/spacex_launch_dash.csv"
```

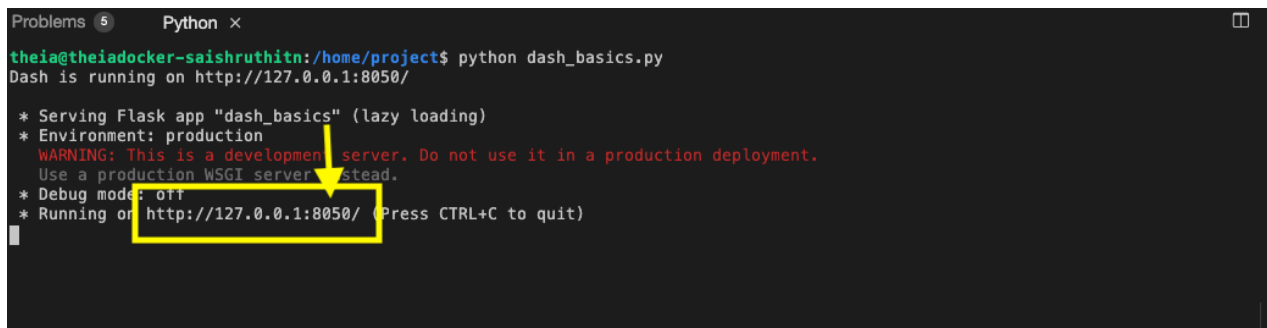
- Download a skeleton Dash app to be completed in this lab:

```
wget "https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DS0321EN-SkillsNetwork/labs/module_3/spacex_dash_app.py"
```

- Test the skeleton app by running the following command in the terminal:

```
python3 spacex_dash_app.py
```

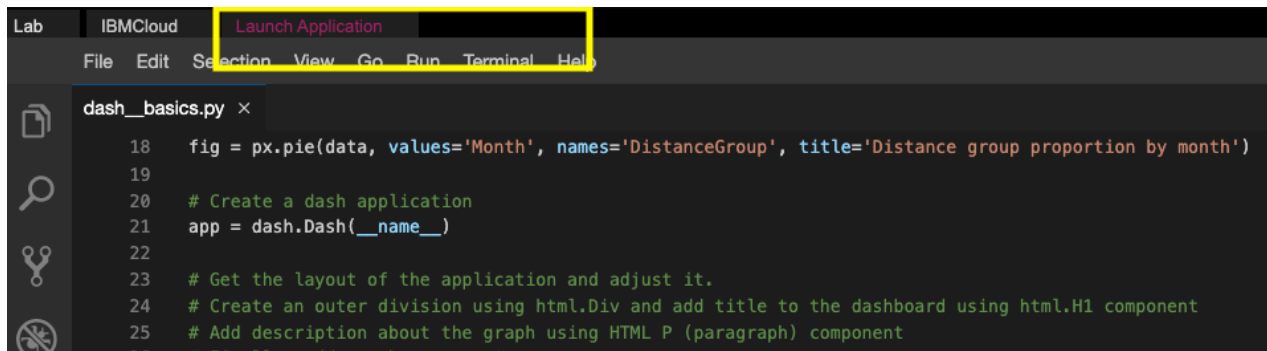
- Observe the port number (8050) shown in the terminal.



```
Problems 5 Python x
theia@theiadocker-saishruthitn:/home/project$ python dash_basics.py
Dash is running on http://127.0.0.1:8050/

* Serving Flask app "dash_basics" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8050/ (Press CTRL+C to quit)
```

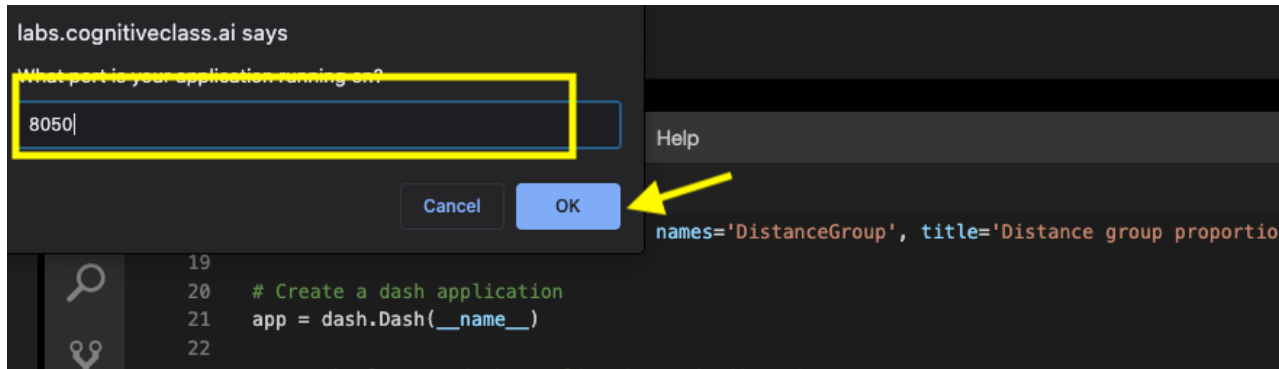
- Click on the `Launch Application` option from the menu bar.



```
Lab  IBMCloud  Launch Application
File Edit Selection View Go Run Terminal Help

dash_basics.py x
18 fig = px.pie(data, values='Month', names='DistanceGroup', title='Distance group proportion by month')
19
20 # Create a dash application
21 app = dash.Dash(__name__)
22
23 # Get the layout of the application and adjust it.
24 # Create an outer division using html.Div and add title to the dashboard using html.H1 component
25 # Add description about the graph using HTML P (paragraph) component
26 # Finally, add dash component
```

- Provide the port number 8050 and click **OK**



- You should see a nearly blank web page indicating a successfully running dash app.

Next, let's fill the skeleton app with required input/output components and callback functions.

TASK 1: Add a Launch Site Drop-down Input Component

We have four different launch sites and we would like to first see which one has the largest success count. Then, we would like to select one specific site and check its detailed success rate (class=0 vs. class=1).

As such, we will need a dropdown menu to let us select different launch sites.

- Find and complete a commented `dcc.Dropdown(id='site-dropdown',...)` input with following attributes:
 - **id** attribute with value `site-dropdown`
 - **options** attribute with a list of launch sites, including a default ALL option
 - **value** attribute with default dropdown value to be ALL meaning all sites are selected
 - **placeholder** attribute to show a text description about this input area, such as `Select a Launch Site here`
 - **searchable** attribute to be True so we can enter keywords to search launch sites

Your completed dropdown menu should look like the following screenshot:

SpaceX Launch Records Dashboard

All Sites
All Sites
CCAFS LC-40
VAFB SLC-4E
KSC LC-39A
CCAFS SLC-40

If you need more reference about `Dropdown()`, refer to the [Plotly Dash Reference](#) section towards the end of this lab.

TASK 2: Add a callback function to render `success-pie-chart` based on selected site dropdown

The general idea of this callback function is to get the selected launch site from `site-dropdown` and render a pie chart visualizing launch success counts.

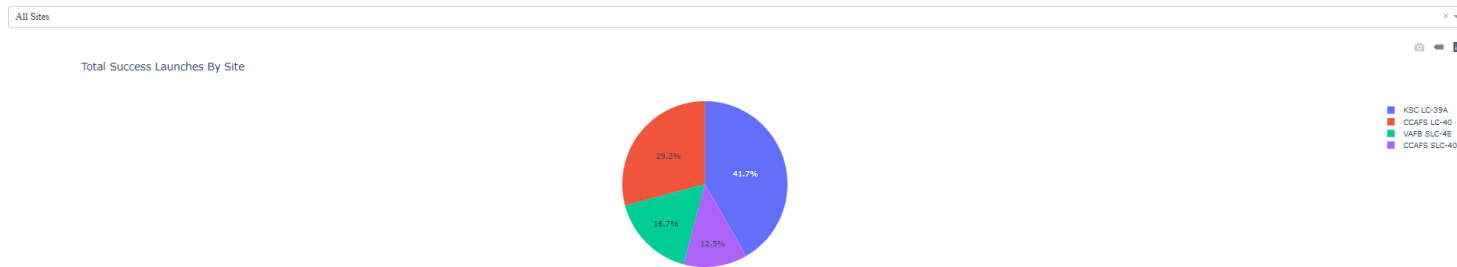
Let's add a call function in `spacex_dash_app.py` including the following application logic:

- Input is set to be the `site-dropdown` dropdown, i.e., `Input(component_id='site-dropdown', component_property='value')`
- Output to be the graph with id `success-pie-chart`, i.e., `Output(component_id='success-pie-chart', component_property='figure')`
- A `If-Else` statement to check if ALL sites were selected or just a specific launch site was selected
 - If ALL sites are selected, we will use all rows in the dataframe `spacex_df` to render and return a pie chart graph to show the total success launches (i.e., the total count of `class` column)
 - If a specific launch site is selected, you need to filter the dataframe `spacex_df` first in order

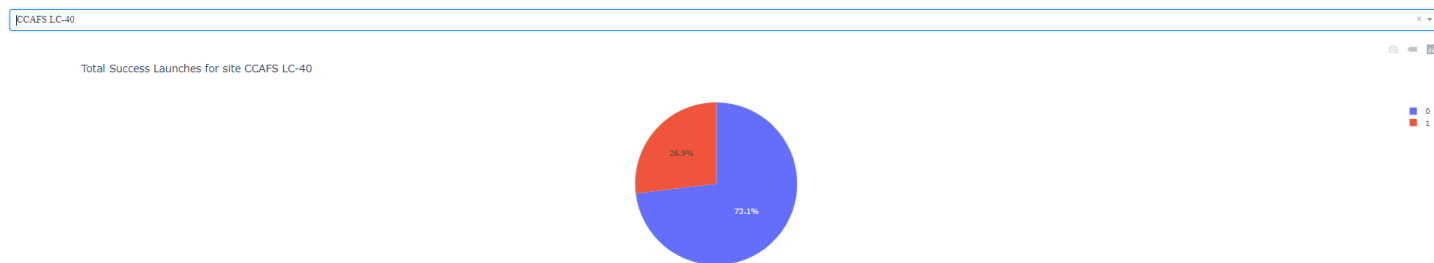
to include the only data for the selected site. Then, render and return a pie chart graph to show the success (`class=1`) count and failed (`class=0`) count for the selected site.

The rendered pie chart should look like the following screenshots:

- Pie chart for all sites are selected



- Pie chart for is selected



If you need more reference about dash callbacks and plotly pie charts, refer to the [Plotly Dash Reference](#) section towards the end of this lab.

TASK 3: Add a Range Slider to Select Payload

Next, we want to find if variable payload is correlated to mission outcome. From a dashboard point of view, we want to be able to easily select different payload range and see if we can identify some visual patterns.

Find and complete a commented `dcc.RangeSlider(id='payload-slider',...)` input with the following attribute:

- `id` to be `payload-slider`
- `min` indicating the slider starting point, we set its value to be 0 (Kg)
- `max` indicating the slider ending point to, we set its value to be 10000 (Kg)
- `step` indicating the slider interval on the slider, we set its value to be 1000 (Kg)
- `value` indicating the current selected range, we could set it to be `min_payload` and `max_payload`

You completed payload range slider should be similar the following screenshot:



If you need more reference about range slider, refer to the [Plotly Dash Reference](#) towards the end of this lab.

TASK 4: Add a callback function to render the **success-payload-scatter-chart** scatter plot

Next, we want to plot a scatter plot with the x axis to be the payload and the y axis to be the launch outcome (i.e., **class** column). As such, we can visually observe how payload may be correlated with mission outcomes for selected site(s).

In addition, we want to color-label the Booster version on each scatter point so that we may observe mission outcomes with different boosters.

Now, let's add a call function including the following application logic:

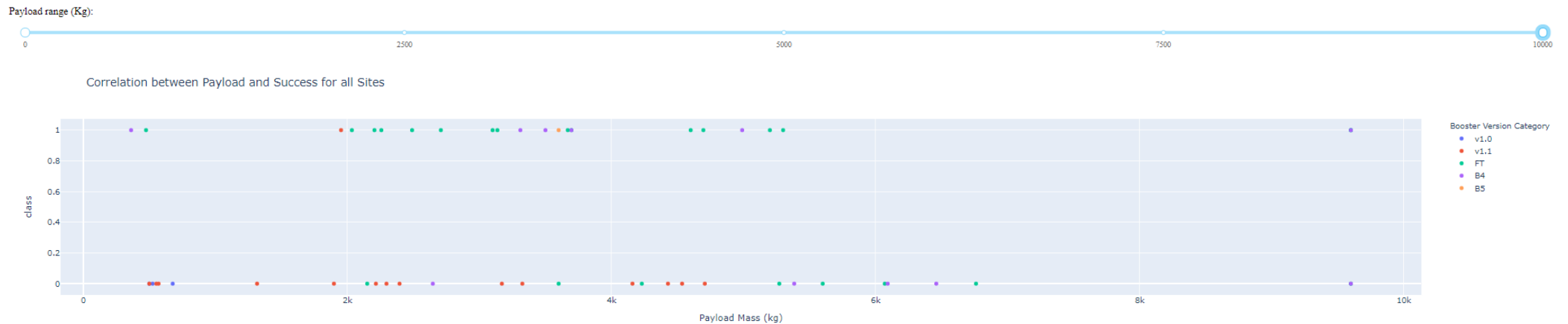
- Input to be `[Input(component_id='site-dropdown', component_property='value'), Input(component_id="payload-slider", component_property="value")]` Note that we have two input components, one to receive selected launch site and another to receive selected payload range
- Output to be `Output(component_id='success-payload-scatter-chart', component_property='figure')`
- A **If-Else** statement to check if ALL sites were selected or just a specific launch site was selected
 - If ALL sites are selected, render a scatter plot to display all values for variable **Payload Mass (kg)** and variable **class**.

In addition, the point color needs to be set to the booster version i.e., `color="Booster Version Category"`

- If a specific launch site is selected, you need to filter the `spacex_df` first, and render a scatter chart to show

values **Payload Mass (kg)** and **class** for the selected site, and color-label the point using **Boosster Version Category** likewise.

You rendered scatter point should look like the following screenshot:



If you need more reference about dash callbacks and plotly scatter plots, refer to the [Plotly Dash Reference](#) towards the end of this lab.

Finding Insights Visually

Now with the dashboard completed, you should be able to use it to analyze SpaceX launch data, and answer the following questions:

1. Which site has the largest successful launches?
2. Which site has the highest launch success rate?
3. Which payload range(s) has the highest launch success rate?
4. Which payload range(s) has the lowest launch success rate?
5. Which F9 Booster version (**v1.0**, **v1.1**, **FT**, **B4**, **B5**, etc.) has the highest

launch success rate?

Plotly Dash Reference

Dropdown (input) component

Refer [here](#) for more details about `dcc.Dropdown()`

Range slider (input) component

Refer [here](#) for more details about `dcc.RangeSlider()`

Callback function

Refer to these [Example Code Snippets](#) about callback function

Pie chart (output) component

Refer [here](#) for more details about plotly pie charts

Scatter chart (output) component

Refer [here](#) for more details about plotly scatter charts

Author

[Yan Luo](#)

Other contributor(s)

Joseph Santarcangelo

Changelog

Date	Version	Changed by	Change Description
06-01-2021	1.0	Yan	Initial version created

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