- **Data Visualisation with Python**
- **Week 1**
- **Syllabus**

Week 1 - Introduction to Data Visualization Tools

- Introduction to Data Visualization
- Introduction to Matplotlib
- Basic Plotting with Matplotlib
- Dataset on Immigration to Canada
- Line Plots
- Lab: Introduction to Matplotlib and Line Plots
- Quiz: Introduction to Data Visualization Tools

Week 2 - Basic and Specialized Visualization Tools

- Area Plots
- Histograms
- Bar Charts
- Pie Charts
- Box Plots
- Scatter Plots
- Bubble Plots
- Lab: Basic Visualization Tools
- Lab: Specialized Visualization Tools
- Quiz: Basic Visualization Tools
- Quiz: Specialized Visualization Tools

Week 3 - Advanced Visualizations and Geospatial Data

- Waffle Charts
- Word Clouds
- Seaborn and Regression Plots
- Introduction to Folium and Map Styles
- Maps with Markers
- Choropleth Maps
- Lab: Advanced Visualization Tools
- Lab: Creating Maps and Visualizing Geospatial Data
- Quiz: Advanced Visualization Tools
- Quiz: Visualizing Geospatial Data
- Peer-review Assignment

- **Introduction to Data Visualisation**
- **4 min**

- welcome to the first module of the data visualization with Python course in this video we're gonna introduce data visualization and go over an example of transforming a given visual into one which is more effective attractive and impactive

- **Introduction to Matplotlib**
- **6 min**

- In this video, we will start learning about Matplotlib. This video will focus on the history of Matplotlib and its architecture.
-
- **Basic plotting with matplotlib**
- **4 min**

- In this video, we will learn how to use Matplotlib to create plots, and we will do so using the Jupyter notebook as our environment.
- This concludes our video on basic plotting with Matplotlib. See you in the next video.
- **Dataset on immigration to Canada**
- **2 min**

- In this video, we will learn more about the dataset that we will be using throughout the course. The population division of the United Nations compiled immigration data pertaining to 45 countries.
- This concludes our video on the immigration to Canada dataset.
- **Line plots**
- **3 min**

- In this video, things will start getting more exciting. We will generate our first visualization tool: the line plot.
- In the lab session, we explore line plots in more detail so make sure to complete this module's lab session. This concludes our video on line plots. I'll see you in the next video.
- **LAB : Introduction to MATPLOTLIB and line plots**
- **https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%201/DV0101EN-Exercise-Introduction-to-Matplotlib-and-Line-Plots.ipynb**
-
- **DV0101EN-1-1-1-Introduction-to-Matplotlib-and-Line 2.ipynb**
- **In GitHub**
- **Quiz**
- **Introduction to Data Visualization Tools**
- Matplotlib was created by John Hunter, an American neurobiologist, and was originally developed as an EEG/ECoG visualization tool.
- Using the notebook backend, you can modify a figure after it is rendered.
- Which of the following are examples of Matplotlib magic functions? Choose all that apply.

%matplotlib notebook

Correct
Correct. The command starts with "%matplotlib" and notebook is one of Matplotlib backends.

%matplotlib inline

Correct
Correct. A sign of a magic function is that it starts with "%matplotlib".

• Basic Visualization Tools

- **Area Plots**
- **4 min**

- **(**
- In this video, we will learn about another visualization tool: the area plot, which is actually an extension of the line plot that we learned about in an earlier video.
- In the lab session, we explore area plots in more details, so make sure to complete this module's lab session. And with this, we conclude our video on area plots. I'll see you in the next video.
-
- **Histograms**
- **4 min**
- **(**

In this video, we will learn about another visualization tool: the histogram, and we will learn how to create it using Matplotlib. In the lab session, we explore histograms in more details, so make sure to complete this module's lab session. And with this, we conclude our video on histograms. I'll see you in the next video.

- **Bar charts**
- **3 min**

In this video, we will learn about an additional visualization tool, namely the bar chart, and learn how to create it using Matplotlib. In the lab session, we reveal the reason and we also learn how to create a bar chart with horizontal bars, so make sure to complete this module's lab session. And with this, we conclude our video on bar charts. I'll see you in the next video.

- **Lab : Basic Visualisation tools**
- https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%202/DV0101EN-Exercise-Area-Plots-Histograms-and-Bar-Charts.ipynb
- **Quiz : Basic Visualization Tools**
- **Area plots are stacked by default.**

The following code will create a histogram of a *pandas* series, **series_data**, and align the bin edges with the horizontal tick marks.

```
count, bin_edges = np.histogram(series_data)
series_data.plot(kind='hist', xticks = bin_edges)
```

3. Given a *pandas* dataframe, **question**, which of the following will create a horizontal bar chart of the data in **question**?

- ```
  question.plot(type='bar', rot=90)
  ```
- ```
  question.plot(kind='bar', orientation='horizontal')
  ```
- ```
  question.plot(kind='barh')
  ```
- ```
  question.plot(kind='bar')
  ```

Barh ✅

Specialized Visualization Tools

Pie Charts
4 min

In this video, we will learn about another visualization tool: the pie chart, and we will learn how to create it using Matplotlib

Box plots
4 min

In this video we will learn about another visualization tool, the Boxplot and how to create one using matplotlib.

Scatter plots
4 min

In this video, we will learn about an additional visualization tool: the scatter plot

Specialized Visualization Tools

https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%203/DV0101EN-Exercise-Pie-Charts-Box-Plots-Scatter-Plots-and-Bubble-Plots.ipynb

Quiz

Quiz : Specialized Visualization Tools

2. What is the correct combination of function and parameter to create a box plot in Matplotlib?

- Function = plot, and Parameter = kind with value = "box"
- Function = box, and Parameter = type with value = "plot"
- Function = plot, and Parameter = kind with value = "boxplot"
- Function = boxplot, and Parameter = type with value = "plot"
- Function = plot, and Parameter = type with value = "box"

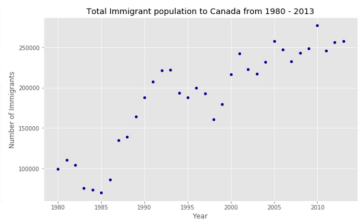
Incorrect
Incorrect. Function = plot, Parameter = kind, with value = "box".

3. Which of the lines of code below will create the following scatter plot, given the *pandas* dataframe, df_total?

1 / 1 point

df_total

year	total
1980	99137
1981	110563
1982	104271
1983	75550
1984	73417
.	.
.	.
2013	258654




```
import matplotlib.pyplot as plt

df_total.plot(type='scatter', x='year', y='total')

plt.title('Total Immigrant population to Canada from 1980 - 2013')
plt.label ('Year')
plt.label('Number of Immigrants')
```

```
import matplotlib.pyplot as plt

df_total.plot(kind='scatter', x='year', y='total')

plt.title('Total Immigrant population to Canada from 1980 - 2013')
plt.xlabel ('Year')
plt.ylabel('Number of Immigrants')
```

- **Advanced Visualisation Tools**
- **Waffle Charts**
- **1min**

- **Word clouds**
- **1 min**

- **Seaborn and regression plots**
- **2 min**

- **Lab : Advanced Visualisation Tools**
- **https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%204/DV0101EN-Exercise-Waffle-Charts-Word-Clouds-and-Regression-Plots.ipynb**

•Quiz

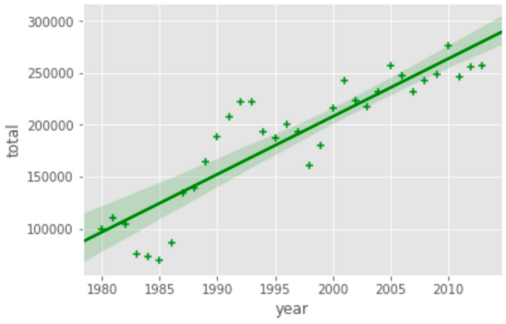
Seaborn is a Python visualization library that is built on top of Matplotlib.

The easiest way to create a waffle chart in Python is using the Python package, PyWaffle.

2. The following code

```
import seaborn as sns
ax = sns.regplot(x="year", y="total", data=data_df, color="green")
```

creates the following regression plot.



- True.
- False.

Correct
Correct.

- **Visualising Geospatial Data**
- **Introduction to Folium**
- **2 min**

- **Maps with Markers**
- **2 min**

- In this video, we will continue working with the Folium library and learn how to superimpose markers on top of a map for interesting visualizations. In the previous video, we learned how to create a world map centred around Canada, so let's create this map again and name it canada_map this time
- This module's lab session is a very interesting one so please make sure to complete it. And with this, we conclude our video on adding markers to maps with Folium. I'll see you in the next video.

- **Chloropleth maps**
- **4 min**
- In this video, we will learn how to create a special type of map called choropleth map with Folium. I'm sure that most of you have seen maps similar to this one and this one.
- In the lab session, we explore choropleth maps in more details, so please make sure to complete this module's lab session. And with this, we conclude our video on choropleth maps.
- **Creating Maps and Visualizing Geospatial Data**
- https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%205/DV0101EN-Exercise-Generating-Maps-in-Python.ipynb
- You cluster markers, superimposed onto a map in Folium, using a marker cluster object.

The following code will generate a map of Spain, displaying its hill shading and natural vegetation.

```
1  folium.Map(location=[40.4637, -3.7492], zoom_start=6, tiles='Stamen Terrain')
```

- A choropleth map is a thematic map in which areas are shaded or patterned in proportion to the measurement of the statistical variable being displayed on the map.
- **Creating Dashboards with Plotly and Dash**
- **Module Overview and Learning Objectives**
- As the saying goes, `A picture worth thousand words`. Data visualization through dashboards will help you uncover information from data that are hidden and democratize the understanding of the extracted information.

- In this topic, you will create a dashboard with theme `US Domestic Airline Flights Performance`. You will do this using a US airline reporting carrier on-time performance dataset, plotly, and dash concepts learned throughout the course.
- **In this module, you will learn**
- - How a dashboard can be used to answer critical business questions.
- - What high-level overview of popular dashboarding tools available in python.
- - How to use basic Plotly, plotly.graph_objects, and plotly express.
- - How to use Dash and basic overview of dash components (core and HTML).
- - How to add different elements (like text box, dropdown, graphs, etc) to the dashboard.
- - How to add interactivity to dash core and HTML components.
- This module will help you get started with dashboard creation using the Plotly library. Hands-on labs will follow each concept to make you comfortable with using the library.
- Reading lists will reference additional resources to learn more about the concepts covered.
- **Dashboarding Overview**
- In this video, we are going to see how an interactive data application can help improve business performance, and the tools available for building the application
- **Additional Resources for Dashboards**
- For more information about Dashboards, visit the following links:
- Python dashboarding tools
- John Snow's data journalism
- **Introduction to Plotly**
- In this video, we are going to provide an overview of the Plotly python library. So, what is Plotly
- **Additional Resources for Plotly**

To learn more about using Plotly to create dashboards, explore

Plotly python

Plotly graph objects with example

Plotly express

API reference

Here are additional useful resources:

Plotly cheatsheet

Plotly community

Related blogs

Open-source datasets

- **Lab : Plotly basics: scatter, line, bar, bubble, histogram, pie, sunburst**
- https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%204/4.3_Plotly_Basics.ipynb
- **Introduction to Dash**
- **4 min video**
-
- In this video, we are going to see an overview of Dash library. Dash is a Open-Source User Interface Python library for creating reactive, web-based applications.

- **Theia Labs Overview**
- https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%204/Overview_Theia.md.html?origin=www.coursera.org
- **Dash basics: HTML and core components**
- **Instructions**
- **https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%204/4.5_Dash_Basics.md.html**
- **Lab link**
- https://labs.cognitiveclass.ai/tools/theiadocker/?md_instructions_url=https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%204/4.5_Dash_Basics.md&lti=true
- **Additional Resources for Dash**
- To learn more about Dash, explore
- Complete dash user guide
- Dash core components
- Dash HTML components
- Dash community forum
- Related blogs
- **Make dashboards interactive**
- **Video**

- In this video, we will see how to connect core and HTML components using callbacks.

- **Additional Resources for Interactive Dashboards**
- To learn more about making interactive dashboards in Dash, visit
- Python decorators reference 1
- Python decorators reference 2
- Callbacks with example
- Dash app gallery
- Dash community components
- **Add interactivity: user input and callbacks**
- https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%204/4.7_Dash_Interactivity.md.html
- **Flight Delay Time Statistics Dashboard**
- **Instructions**
- **https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%204/4.8_Flight_Delay_Time_Statistics_Dashboard.md.html**
-
- **Lesson Summary**

- Best dashboards answer critical business questions. It will help business make informed decisions, thereby improving performance.

- Dashboards can produce real-time visuals.

- Plotly is an interactive, open-source plotting library that supports over 40 chart types.

- The web based visualizations created using Plotly python can

be displayed in Jupyter notebook, saved to standalone HTML files, or served as part of pure Python-built web applications using Dash.

- Plotly Graph Objects is the low-level interface to figures, traces, and layout whereas plotly express is a high-level wrapper for Plotly.

- Dash is an Open-Source User Interface Python library for creating reactive, web-based applications. It is both enterprise-ready and a first-class member of Plotly's open-source tools.

- Core and HTML are the two components of dash.

- The dash_html_components library has a component for every HTML tag.

- The dash_core_components describe higher-level components that are interactive and are generated with JavaScript, HTML, and CSS through the React.js library.

- A callback function is a python function that is automatically called by Dash whenever an input component's property changes. Callback function is decorated with `@app.callback` decorator.

- Callback decorator function takes two parameters: Input and Output. Input and Output to the callback function will have component id and component property. Multiple inputs or outputs should be enclosed inside either a list or tuple.

- Graded Quiz

- Plotly express is a High level wrapper

Question 2
@app_callback is the callback decorator.

False

correct way of adding callback decorator

@app.callback(Output(component_id='bar-plot',
component_property='figure'),

Input(component_id='input-yr',
component_property='value'))

Week 5

Final Assignment

Practice Assignment

Instructions

https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%205/5.1_PracticeLab.md.html

Final Assignment

https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DV0101EN-SkillsNetwork/labs/Module%205/5_Peer_Graded_Assignment_Questions.ipynb

Final exam quiz questions

PDF