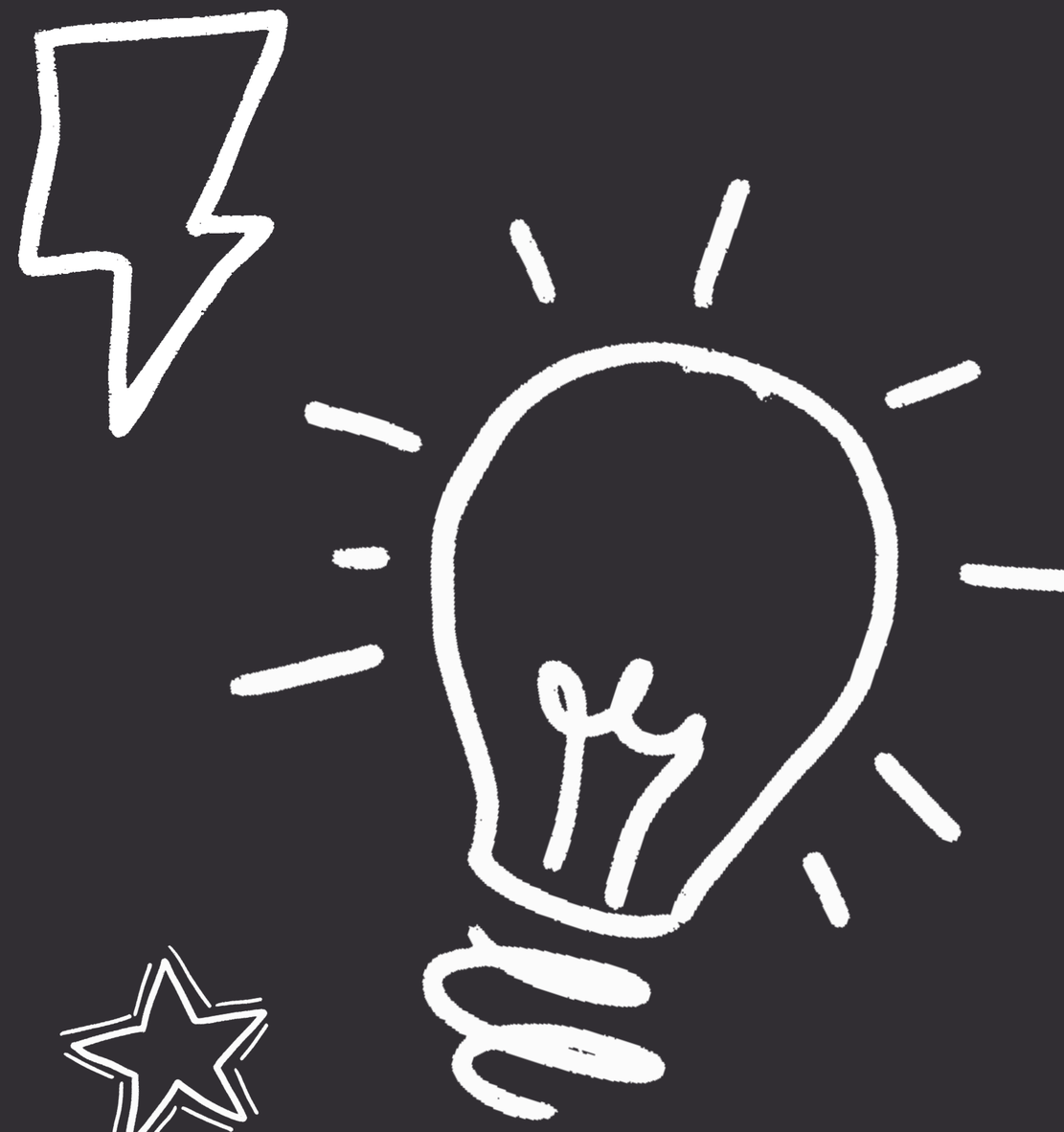
NASA TOPS

Cyber Security



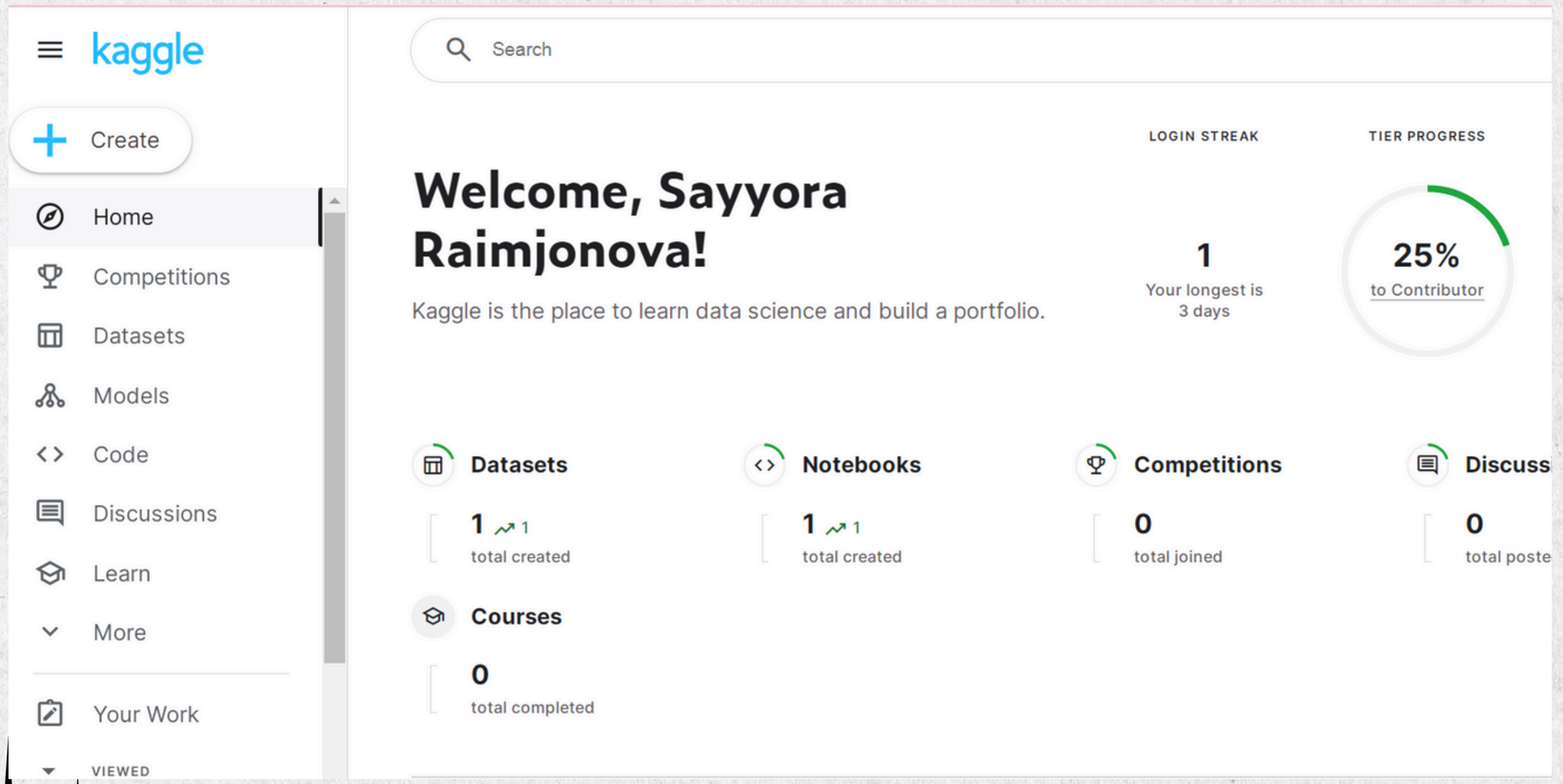
Presenters:

Aibiike, Sayyora, Nadim, Zeesham, Mohammed, Anas, Yesenia

Date:

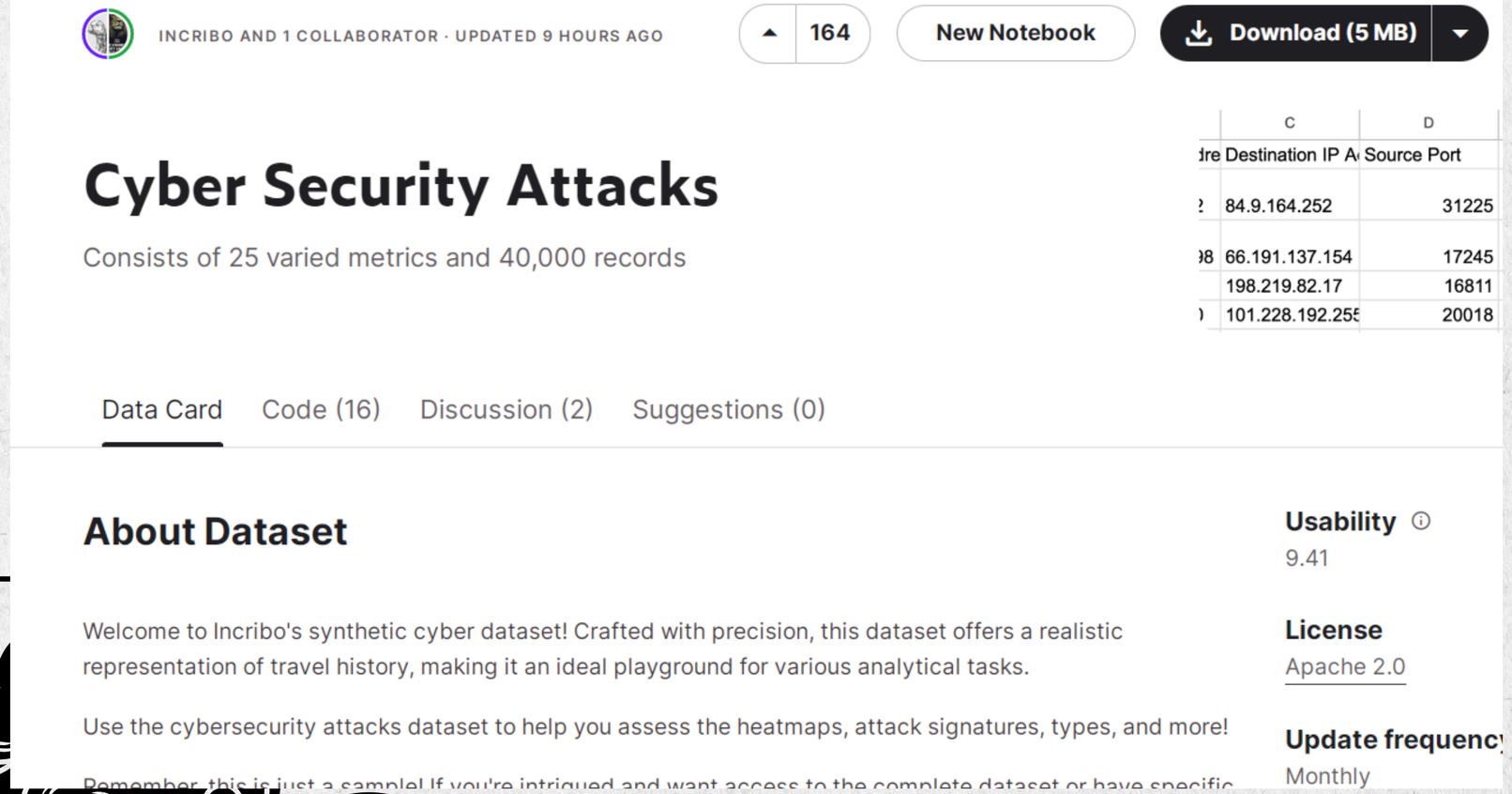
19 JULY 2024

KAGGLE



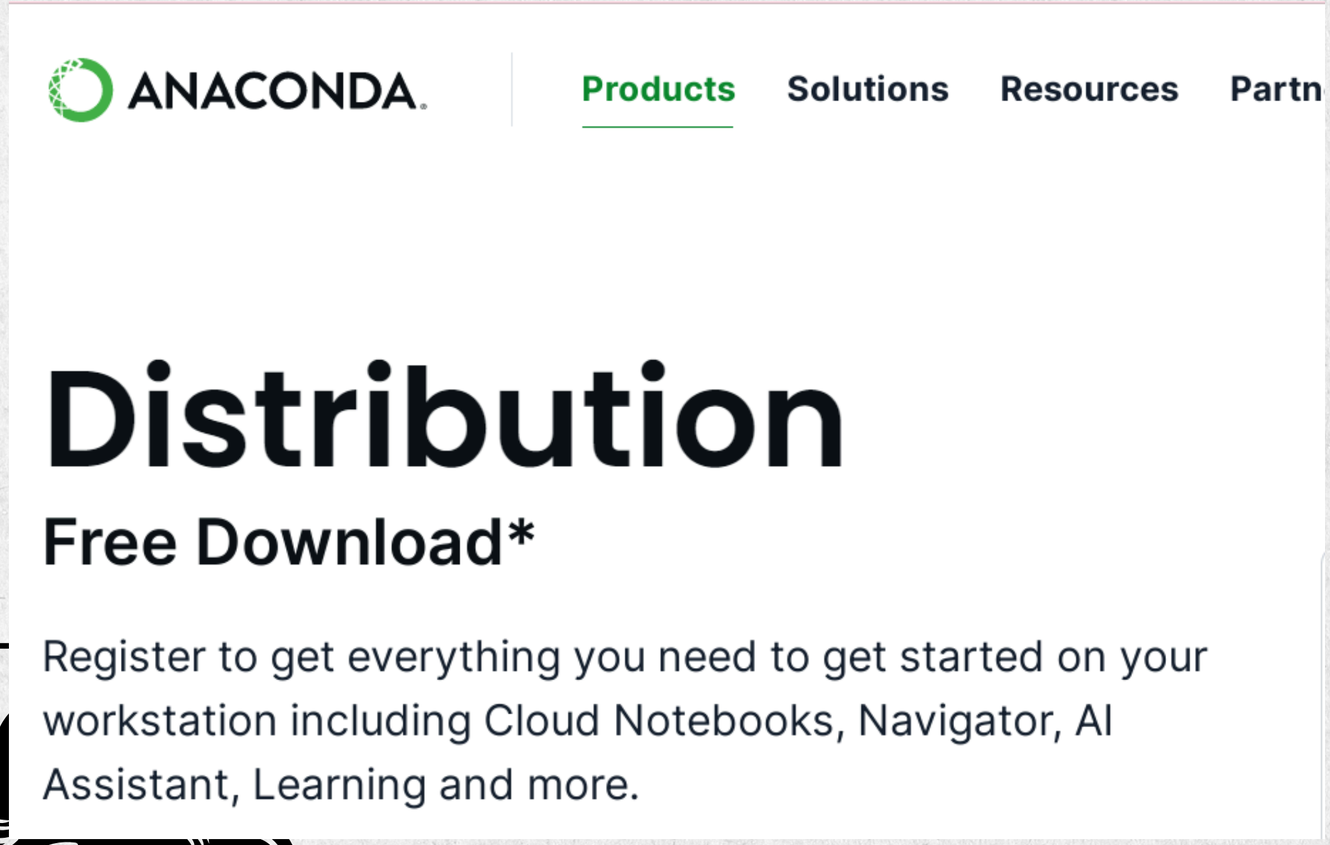
Kaggle is a website where you can find lots of datasets for different subjects

DATASETS



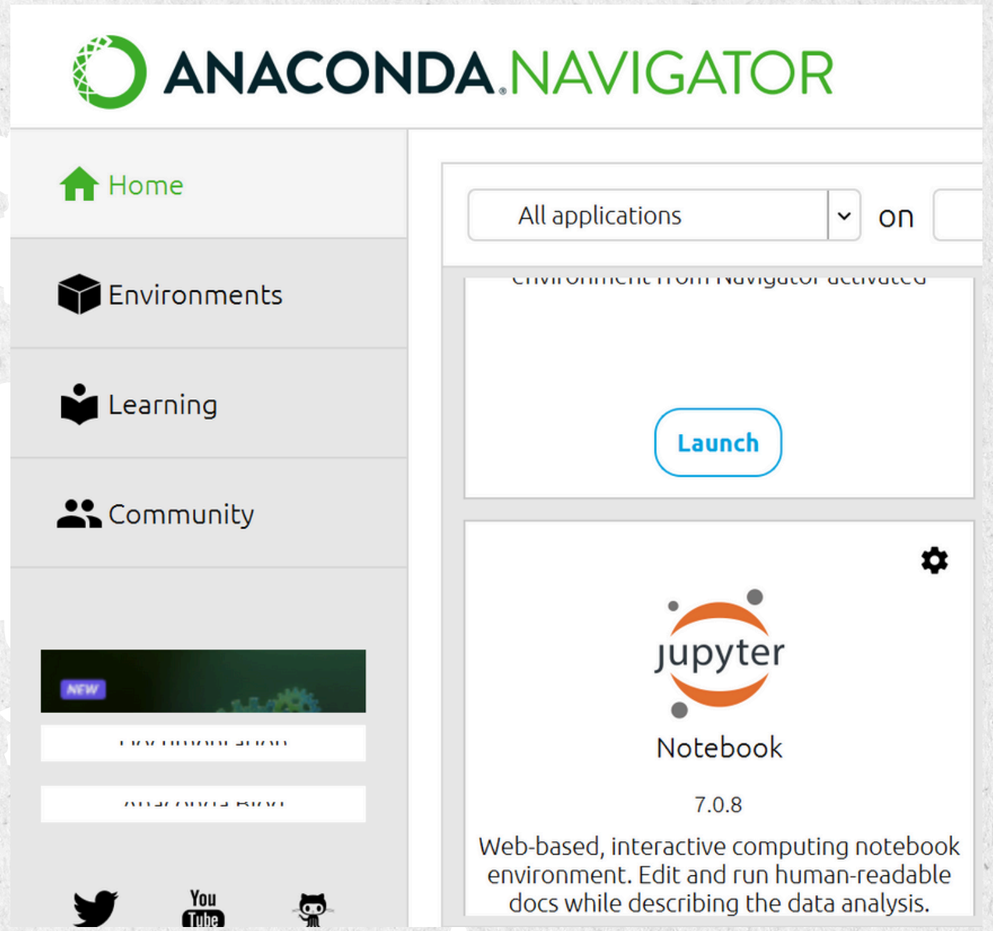
A dataset is a collection of data, usually organized in a table or a structured format

ANACONDA



Anaconda is a distribution that makes it easy to use the Python and R programming languages for scientific computing.

JUPYTER NOTEBOOK



Jupyter Notebook: An interactive web-based interface where you can write and execute code, visualize data, and document your analysis in one place.

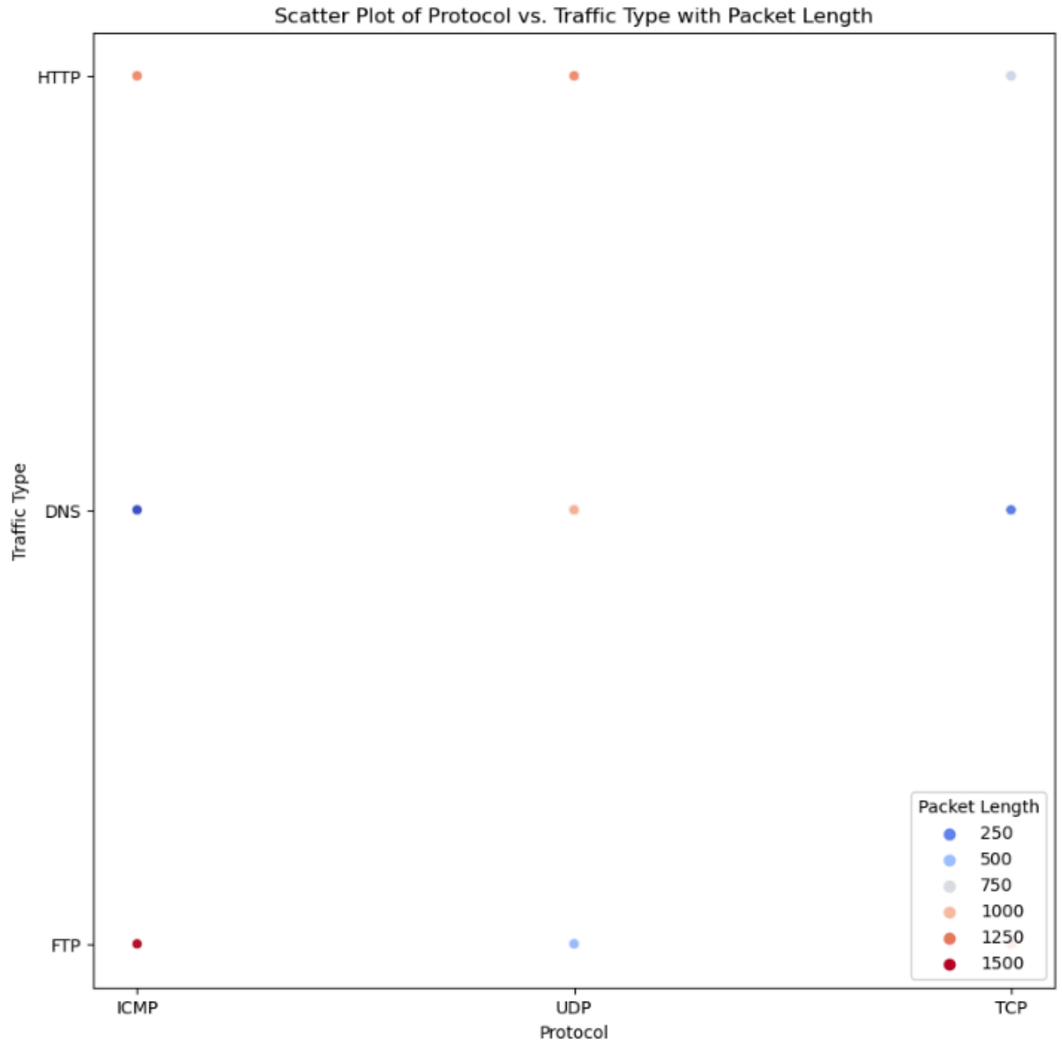
[4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 40000 entries, 0 to 39999
Data columns (total 25 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   Timestamp               40000 non-null  object 
 1   Source IP Address       40000 non-null  object 
 2   Destination IP Address  40000 non-null  object 
 3   Source Port             40000 non-null  int64  
 4   Destination Port        40000 non-null  int64  
 5   Protocol                40000 non-null  object 
 6   Packet Length           40000 non-null  int64  
 7   Packet Type             40000 non-null  object 
 8   Traffic Type            40000 non-null  object 
 9   Payload Data            40000 non-null  object 
 10  Malware Indicators      20000 non-null  object 
 11  Anomaly Scores          40000 non-null  float64
 12  Alerts/Warnings         19933 non-null  object 
 13  Attack Type             40000 non-null  object 
 14  Attack Signature        40000 non-null  object 
 15  Action Taken            40000 non-null  object 
 16  Severity Level          40000 non-null  object 
 17  User Information        40000 non-null  object 
 18  Device Information      40000 non-null  object 
 19  Network Segment         40000 non-null  object 
 20  Geo-location Data       40000 non-null  object 
 21  Proxy Information       20149 non-null  object 
 22  Firewall Logs           20039 non-null  object 
 23  IDS/IPS Alerts          19950 non-null  object 
 24  Log Source              40000 non-null  object 
dtypes: float64(1), int64(3), object(21)
memory usage: 7.6+ MB
```

In this project, we analyze 40,000 records of cybersecurity attack data across 25 varied metrics to gain insights and improve our security measures.

```
[5]: plt.figure(figsize=(10, 10))
     sns.scatterplot(data=df, x='Protocol', y='Traffic Type', hue='Packet Length', palette='coolwarm')
     plt.title('Scatter Plot of Protocol vs. Traffic Type with Packet Length')
     plt.xlabel('Protocol')
     plt.ylabel('Traffic Type')


     #plt.legend(title='Packet Length')
     plt.show()
```

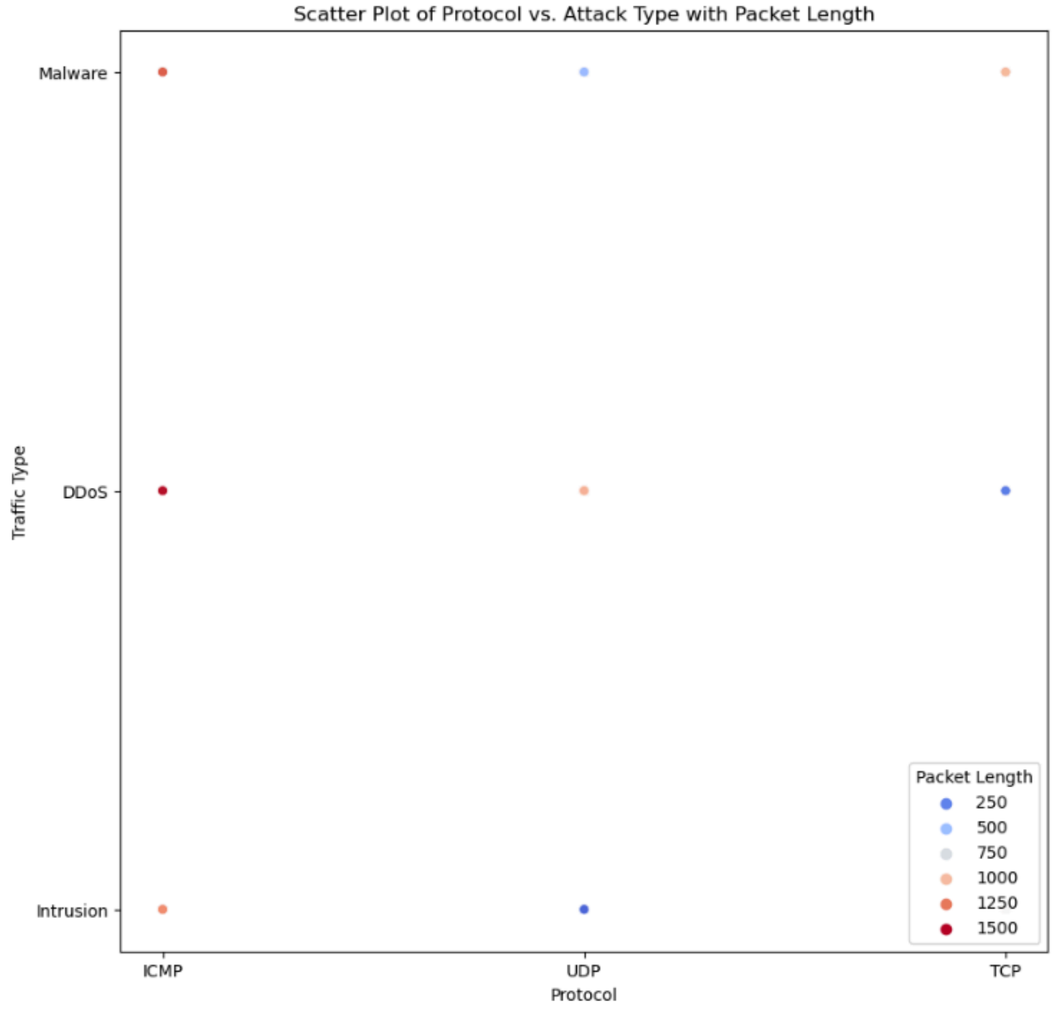


Protocol Analysis and ICMP Dominance:

- Visualization: Scatter Plot of Protocol vs. Traffic Type with Packet Length.
- Insight: The scatter plot revealed that the majority of attacks were conducted using the ICMP (Internet Control Message Protocol) protocol. This protocol is commonly used for network diagnostics.

```
[14]: plt.figure(figsize=(10, 10))
      sns.scatterplot(data=df, x='Protocol', y='Attack Type', hue='Packet Length', palette='coolwarm')
      plt.title('Scatter Plot of Protocol vs. Attack Type with Packet Length')
      plt.xlabel('Protocol')
      plt.ylabel('Traffic Type')


      #plt.legend(title='Packet Length')
      plt.show()
```

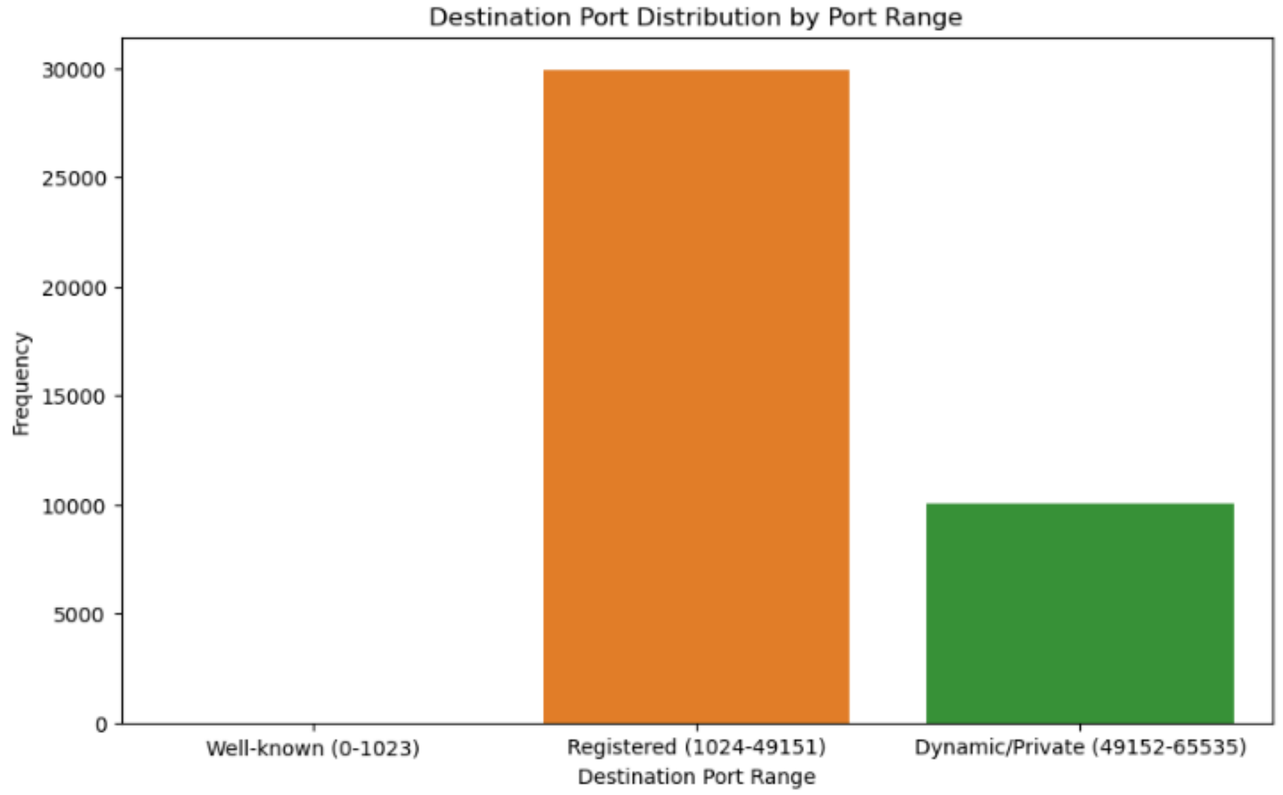


Attack Types and Packet Length:

- Visualization: Scatter Plot of Protocol vs. Attack Type with Packet Length.
- Insight: This highlights that DDoS (Distributed Denial of Service) attacks tend to carry the largest packet lengths and are primarily conducted over the ICMP protocol. This insight underscores the need for robust defenses against DDoS attacks, particularly focusing on ICMP traffic.

```
[13]: df['Destination Port Range'] = df['Destination Port'].apply(categorize_port)

plt.figure(figsize=(10, 6))
sns.countplot(data=df, x='Destination Port Range', order=['Well-known (0-1023)', 'Registered (1024-49151)', 'Dynamic/Private (49152-65535)'])
plt.title('Destination Port Distribution by Port Range')
plt.xlabel('Destination Port Range')
plt.ylabel('Frequency')
plt.show()
```



Port Range Analysis:

- Visualization: Histogram of Destination Port Distribution by Port Range.
- Insight: The histogram showed that most attacks target registered ports (1024-49151) and dynamic/private ports (49152-65535). This finding suggests that security measures should be particularly stringent for these port ranges, as they are frequent targets for cyber attacks.

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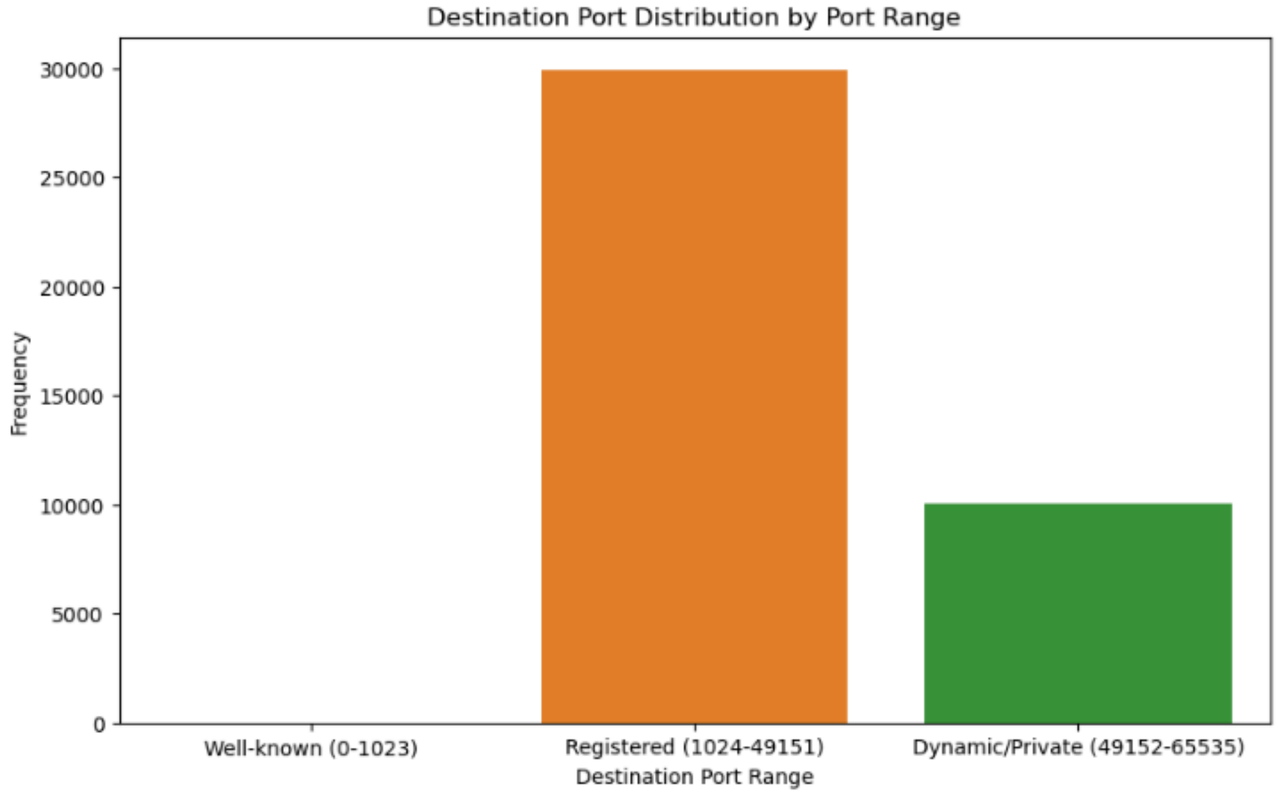

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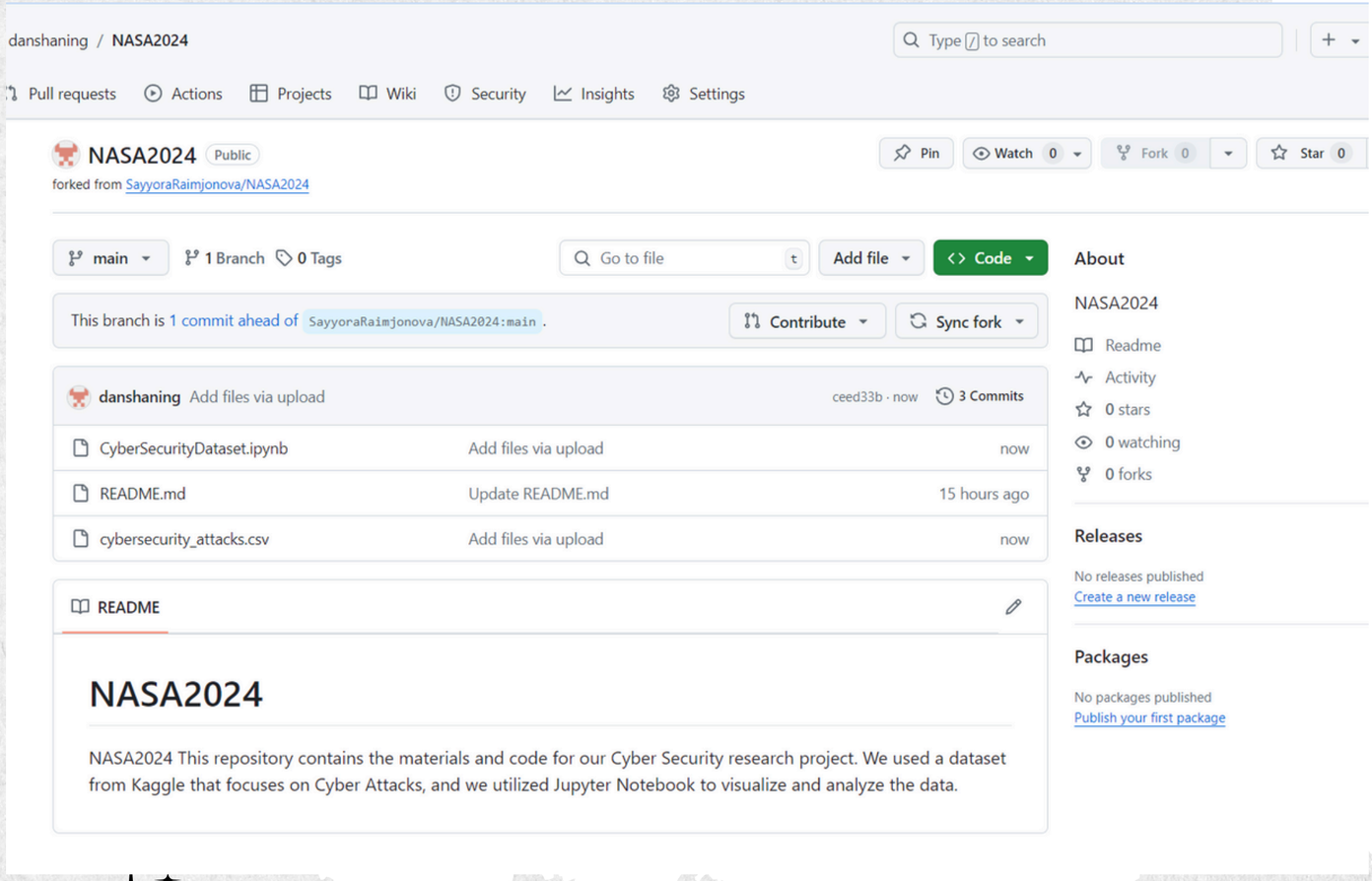

Open Science Commitment

In alignment with NASA TOPS' objective to advance open science, we are sharing our project to foster transparency and collaboration.

Access Our Work:

- GitHub Repository: Explore our Jupyter Notebook, data, and visualizations.
- Repository Link: https://github.com/danshaning/NASA2024

Project Impact:

- Hands-on Experience: This project provided invaluable hands-on experience with large datasets and the use of tools like Kaggle for data sourcing.
- Skill Development: We enhanced our skills in data analysis and visualization, critical for cybersecurity research and response strategies.
- Collaborative Learning: Working on this project as a team fostered collaboration and improved our ability to analyze complex data sets collectively.