National College of Ireland

Network-based Intrusion Detection System for Preventing the Cloud Computing Environment from Cyber-Attacks using Deep Learning Algorithms

MSc Research Project
MSc in Cloud Computing

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Project Submission Sheet
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Network-based Intrusion Detection System for Preventing the Cloud Computing Environment from Cyber-Attacks using Deep Learning Algorithms

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1 System Requirements

In this con guration manual, I have described in detail the basic software and hardware prerequisites necessary for the project to work successfully. I have detailed the hardware requirements and software version required to perform the code.

1.1 Software:-

- Python Version - 3.9.7
- tensor ow Version - 2.8.0
- numpy Version - 1.20.3
- pandas Version - 1.3.4
- matplotlib Version - 3.5.2
- seaborn Version - 0.11.2

1.2 Hardware:-

The hardware con guration of machine where i executed my implemented project are as follows.

- RAM: - 16 GB
- Storage (SSD): - 512GB
- Processor: - 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz 3.30 GHz
- Operating System: - Windows 10 Home Edition, 64-bit operating system, x64-based processor

2 ML Packages

In this section we will discuss few ML packages that we are using in our project.

1. NumPy: Numerical Python is what it refers to in its most basic form, and its components are multidimensional array objects. There are a few signi cant operations that we are able to carry out, such as mathematical and logical operations on arrays, the Fourier transformation, and operations connected with linear algebra [1].

    - Installation
      pip install NumPy

    - Execution
      import numpy as np

2. Pandas: Pandas is utilized primarily for tasks involving the manipulation, wrangling, and analysis of data. In 2008, Wes McKinney was the one who came up with the idea for it. We are able to load data, prepare it, manipulate it, model it, and do analyses with the assistance of Pandas [2].

    - Installation
      pip install Pandas

    - Execution
      import pandas as pd

3. Scikit-learn: NumPy, SciPy, and Matplotlib were used in its development. It is free to use and can be redistributed as long as the BSD license is followed. Everyone has access to it, and it can be repurposed in a variety of di erent settings. With its assistance, a wide variety of machine learning algorithms can be put into action. These algorithms cover signi cant sub elds of machine learning, including classi cation, clustering, regression, dimensionality reduction, and model selection, amongst others [3].

    - Installation
      pip install -U scikit-learn

    - Execution
      from sklearn.datasets import PCA

4. TensorFlow: TensorFlow is a platform for machine learning that is open-source as well as a symbolic math library that is utilized for applications related to machine learning. The majority of our work is done in Keras with TensorFlow. It is a library for Open Source Neural Networks that can be run on top of Tensor ow. It is developed to be quick and simple for the user to operate at all times. It is a helpful library that can be used to design any deep learning algorithm of our choice [4].

[1] https://www.tutorialspoint.com/machine_learning_with_python=machine_learning_with_python_jupyter_notebook:htm
[2] https://www.tutorialspoint.com/machine_learning_with_python=machine_learning_with_python_jupyter_notebook:htm
[3] https://www.tutorialspoint.com/machine_learning_with_python=machine_learning_with_python_jupyter_notebook:htm
[4] https://www.geeksforgeeks.org/di erence-between-tensor ow-and-keras/

- Installation
  python3 -m pip install tensor ow

- Execution
  import tensor ow as tf

3 Dataset

KDD-99 Dataset is what's utilized for the study of malware tra c in cloud computing environments, and it was created by KDD (KDD Cup 1999 Data, 2022). It is a reorganized dataset that has been improved and updated primarily for the purpose of malware analysis. Because it includes all of the most recent information about malware assaults such as DoS, R2L, U2R, and probing, this dataset is considered to be an ideal candidate for use in the construction of an Intrusion Detection System.

Link for the data is: http://kdd.ics.uci.edu/databases/kddcup99/kddcup99.html

4 Software Tools

4.1 Jupyter Notebook

Jupyter notebooks, in their most basic form, o er an interactive computing environment that can be used for the development of Python-based Data Science applications. Because Jupyter notebooks are able to explain the analysis process in a step-by-step manner by arranging the various components such as code, images, text, and output in a manner that is step-by-step, it is one of the best components that the Python ML ecosystem has to o er [5].

Installation and Execution: Using normal Python, jupyter notebook may be installed using pip.

pip install jupyter

4.2 Visual Code

4.2.1 Jupyter Notebooks in VS Code

Working with Jupyter Notebooks can be done natively in Visual Studio Code, or it can be done through Python source code les.

4.2.2 Setting up your environment

To use Python in Jupyter Notebooks, activate Anaconda in VS Code or any Python environment with the Jupyter package. (Ctrl+Shift+P) to select an environment.

[5] https://www.tutorialspoint.com/machine_learning_with_python=machine_learning_with_python_jupyter_notebook:htm

Once the environment is activated, you can create and open a Jupyter Notebook, connect to a remote Jupyter server, and export a Jupyter Notebook as a Python le. [6]

4.2.3 Running cells

After you've created a Notebook, you may execute a code cell by clicking the Run icon to the left of the cell, and the output will show up just beneath the code cell.

Code can also be executed by using keyboard shortcuts. Use Ctrl+Enter or Shift+Enter to run the current cell while in command or edit mode, respectively, and to move on to the next cell [7]. Figure 1

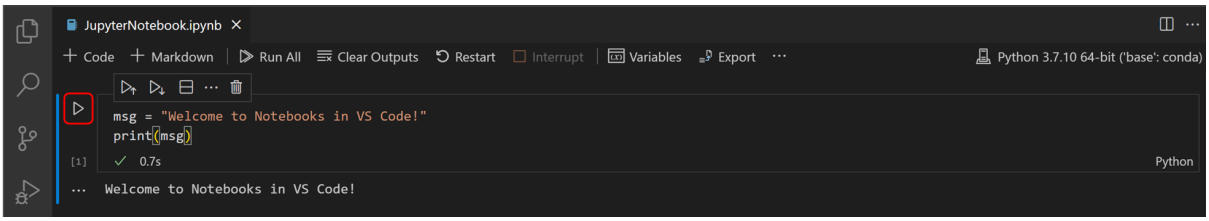

Figure 1: Run Cell

You can run multiple cells by selecting Run All, Run All Above, or Run All Below. Figure 3

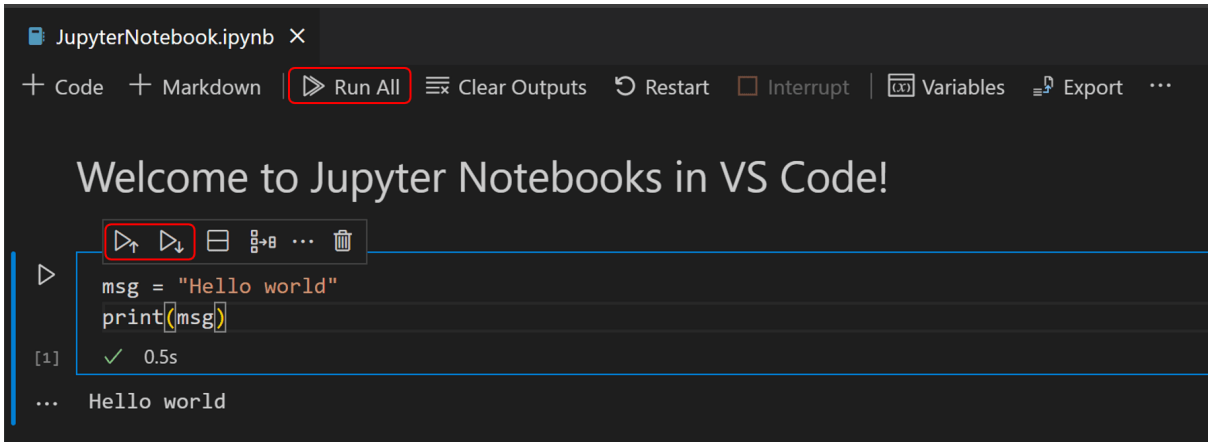

Figure 2: Run All Cells

4.2.4 Save your Jupyter Notebook

You can save your work in your Jupyter Notebook by selecting File > Save from the menu bar or using the keyboard shortcut Ctrl+S.

[6] https://code.visualstudio.com/docs/datascience/jupyter-notebooks
[7] https://code.visualstudio.com/docs/datascience/jupyter-notebooks

5 Project Execution

Here, we will find how to run the project successfully.

1. You need to first download the code as zip from link `https://github.com/shri1900/ids`
2. The models are pre-trained, so just need to run client and server models
   intrusion-update : is model comparison script
   source.py : file which produces data and send it to server
   server.py : file which accepts incoming data and runs model on it
3. Run python source.py
4. Run python server.py
5. Make sure to run them on different teminals. Files currently run on local host it can be modified for different source and host machines

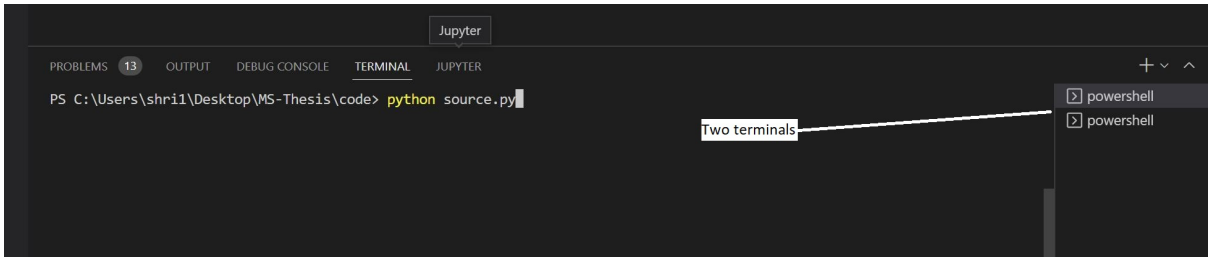

Figure 3: Open two terminals

6 Results

Once you run the client and server commands in two terminals, you will start getting the results that states what type of attack was detected.

- Client Fig4

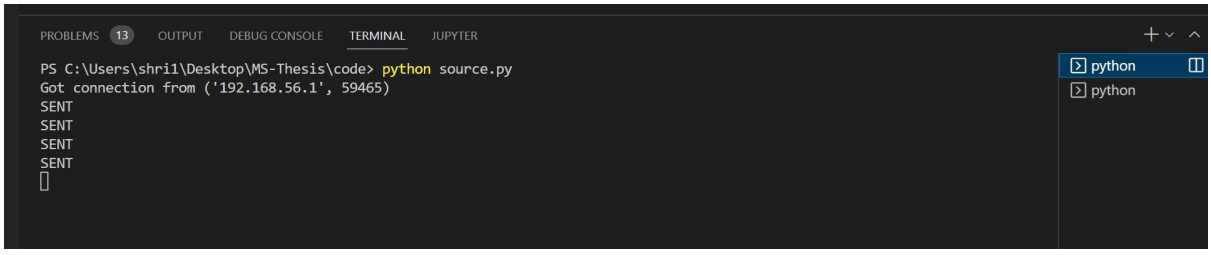

Figure 4: Client terminal