OST Class Assignment

NAME : DHWANI BHAVANKAR
BRANCH : AIML A2
PRN : 22070126034

Automating Model Training & Deployment

1. Introduction

Machine learning models degrade over time as data patterns evolve. Manually training and deploying models is inefficient and error-prone. This script automates the training, evaluation, versioning, and deployment of an AI-powered fraud detection model.

---

2. Steps Involved in Automation

Step 1: User Input for Directory Locations

- The script prompts the user to enter paths for:
  - **Data directory** (where new training data is stored)
  - **Model storage directory** (where trained models are saved)
  - **Deployment directory** (where the latest model is stored)
  - **Log file path** (to store process logs)

Step 2: Check for New Data

- The script verifies if new data is available in the specified directory.
- If no new data is found, the script exits.

Step 3: Train the Model

- Calls `train_model.py` with the new data.
- Saves the trained model with a timestamped filename.

Step 4: Evaluate the Model

- Calls `evaluate_model.py` to check the model's performance.
- Logs the evaluation results in the log file.
- If the new model does not perform better than the previous version, deployment is skipped.

Step 5: Deploy the Model

- If performance improves, the script:
    - Copies the trained model to the deployment directory.
    - Archives old models for version tracking.

Step 6: Restart the Service

- Restarts the **fraud detection service** to apply the new model.

---

3. Requirements

Software & Dependencies

- Linux/macOS environment
- Python 3.x
- Required Python libraries (`scikit-learn`, `pandas`, etc.)
- Systemd (for restarting services)

Python Scripts Used

1. `train_model.py` – Trains a fraud detection model.
2. `evaluate_model.py` – Assesses model performance and logs results.

---

4. How to Run the Script

1. **Ensure the required Python scripts (`train_model.py` and `evaluate_model.py`) are available.**
2. **Make the shell script executable:**

```
bash
CopyEdit
chmod +x mlScript.sh
```

3. **Run the script:**

```
bash
CopyEdit
./mlScript.sh
```

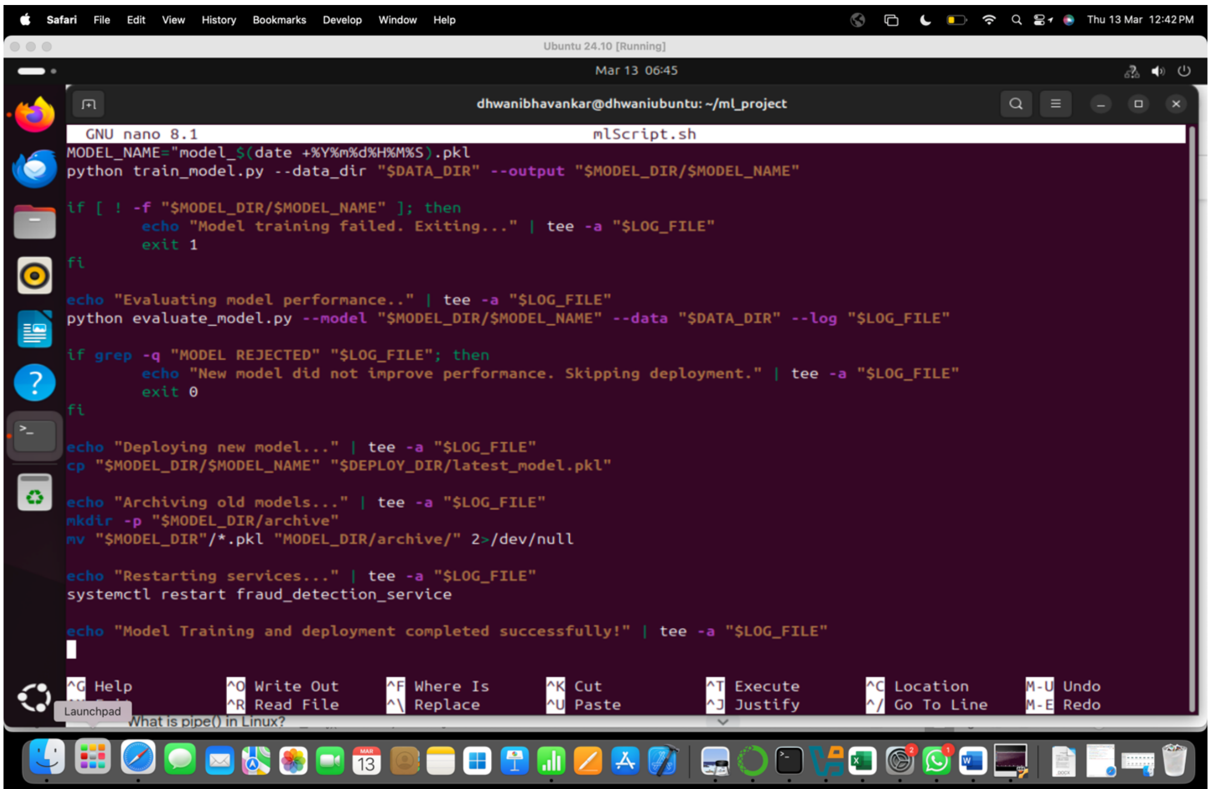
---

5. Version Control & Tracking

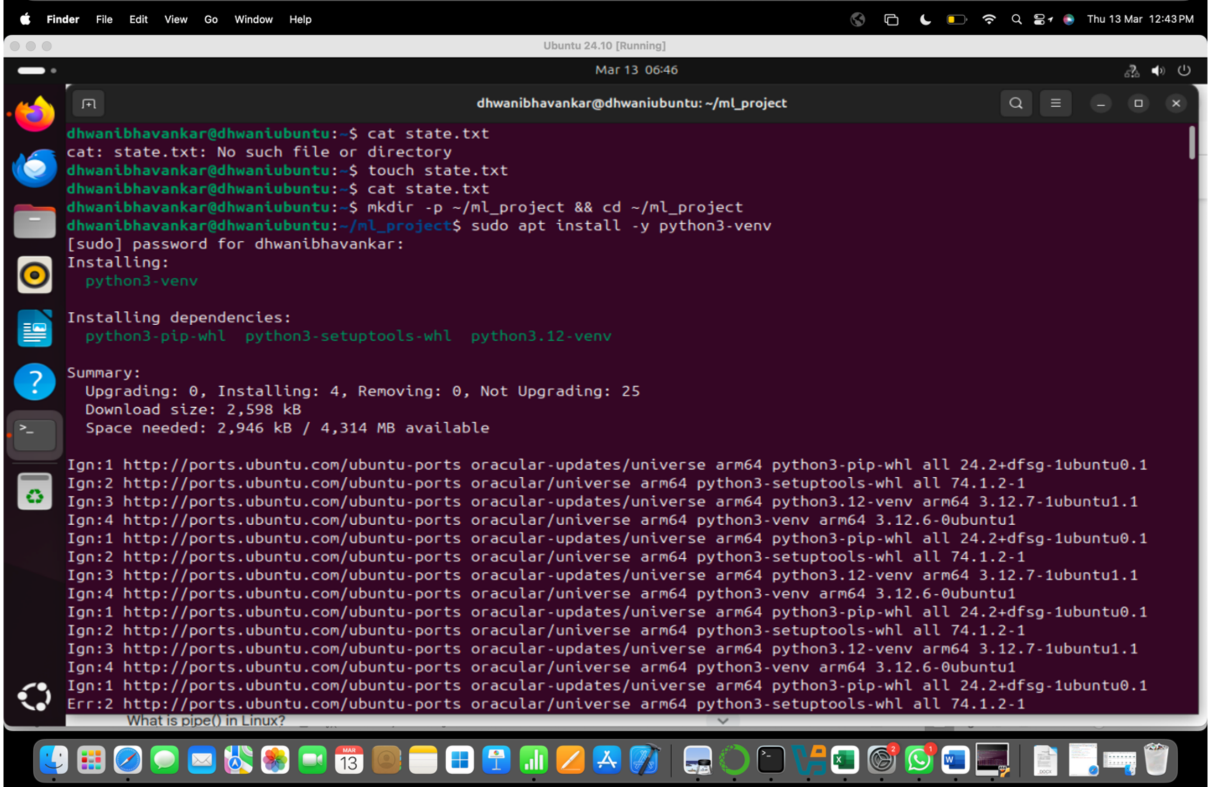
- Trained models are saved with timestamps.
- Old models are archived for future reference.
- Log files track each training and deployment event.

```bash
#!/bin/bash

echo "Enter the directory where new data is stored:"
read DATA_DIR
echo "Enter the directory where models should be saved:"
read MODEL_DIR
echo "Enter the deployment directory:"
read DEPLOY_DIR
echo "Enter the log file path:"
read LOG_FILE

echo "Starting automated model training and deployment..." | tee -a "$LOG_FILE"

if [ -z "$(ls -A $DATA_DIR)" ]; then
   echo "No new data found. Exiting..." | tee -a "$LOG_FILE"
   exit 1
fi

echo "Training model with new data..." | tee -a "$LOG_FILE"
MODEL_NAME="model_$(date +%Y%m%d%H%M%S).pkl"
python train_model.py --data_dir "$DATA_DIR" --output "$MODEL_DIR/$MODEL_NAME"

if [ ! -f "$MODEL_DIR/$MODEL_NAME" ]; then
   echo "Model training failed. Exiting..." | tee -a "$LOG_FILE"
   exit 1
fi

echo "Evaluating model performance..." | tee -a "$LOG_FILE"
python evaluate_model.py --model "$MODEL_DIR/$MODEL_NAME" --data "$DATA_DIR" --
log "$LOG_FILE"

if grep -q "MODEL REJECTED" "$LOG_FILE"; then
   echo "New model did not improve performance. Skipping deployment." | tee -a
"$LOG_FILE"
   exit 0
fi

echo "Deploying new model..." | tee -a "$LOG_FILE"
cp "$MODEL_DIR/$MODEL_NAME" "$DEPLOY_DIR/latest_model.pkl"

echo "Archiving old models..." | tee -a "$LOG_FILE"
mkdir -p "$MODEL_DIR/archive"
mv "$MODEL_DIR"/*.pkl "$MODEL_DIR/archive/" 2>/dev/null
```

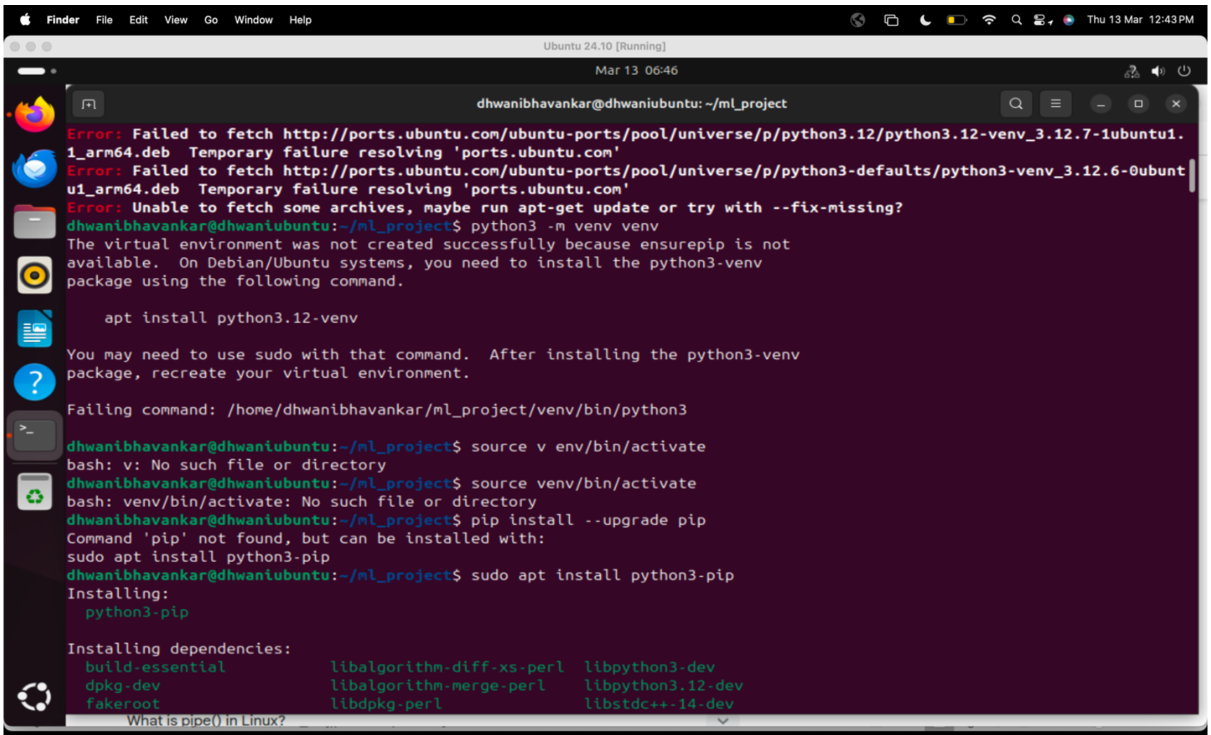
```
echo "Restarting services..." | tee -a "$LOG_FILE"
systemctl restart fraud_detection_service

echo "Model training and deployment completed successfully!" | tee -a "$LOG_FILE"
```


Safari File Edit View History Bookmarks Develop Window Help
Thu 13 Mar 12:42 PM
Ubuntu 24.10 [Running]
Mar 13 06:45
dhwanibhavankar@dhwaniubuntu: ~/ml_project
Launchpad
What is pipe() in Linux?

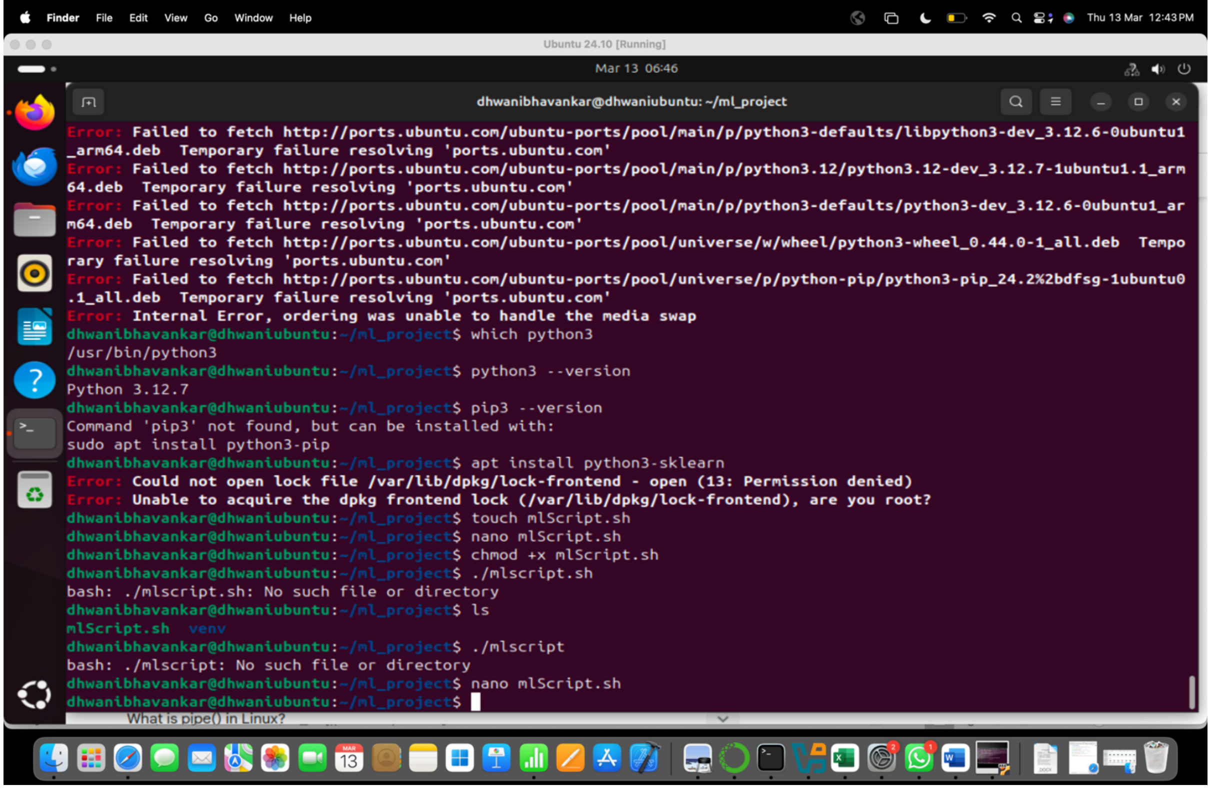
```
  GNU nano 8.1                                   mlScript.sh
MODEL_NAME="model_$(date +%Y%m%d%H%M%S).pkl
python train_model.py --data_dir "$DATA_DIR" --output "$MODEL_DIR/$MODEL_NAME"

if [ ! -f "$MODEL_DIR/$MODEL_NAME" ]; then
        echo "Model training failed. Exiting..." | tee -a "$LOG_FILE"
        exit 1
fi

echo "Evaluating model performance.." | tee -a "$LOG_FILE"
python evaluate_model.py --model "$MODEL_DIR/$MODEL_NAME" --data "$DATA_DIR" --log "$LOG_FILE"

if grep -q "MODEL REJECTED" "$LOG_FILE"; then
        echo "New model did not improve performance. Skipping deployment." | tee -a "$LOG_FILE"
        exit 0
fi

echo "Deploying new model..." | tee -a "$LOG_FILE"
cp "$MODEL_DIR/$MODEL_NAME" "$DEPLOY_DIR/latest_model.pkl"

echo "Archiving old models..." | tee -a "$LOG_FILE"
mkdir -p "$MODEL_DIR/archive"
mv "$MODEL_DIR"/*.pkl "MODEL_DIR/archive/" 2>/dev/null

echo "Restarting services..." | tee -a "$LOG_FILE"
systemctl restart fraud_detection_service

echo "Model Training and deployment completed successfully!" | tee -a "$LOG_FILE"


^G Help        ^O Write Out   ^F Where Is    ^K Cut         ^T Execute     ^C Location    M-U Undo
^X Exit        ^R Read File   ^\ Replace     ^U Paste       ^J Justify     ^/ Go To Line  M-E Redo
```


Finder File Edit View Go Window Help
Thu 13 Mar 12:43 PM
Ubuntu 24.10 [Running]
Mar 13 06:46
dhwanibhavankar@dhwaniubuntu: ~/ml_project
What is pipe() in Linux?

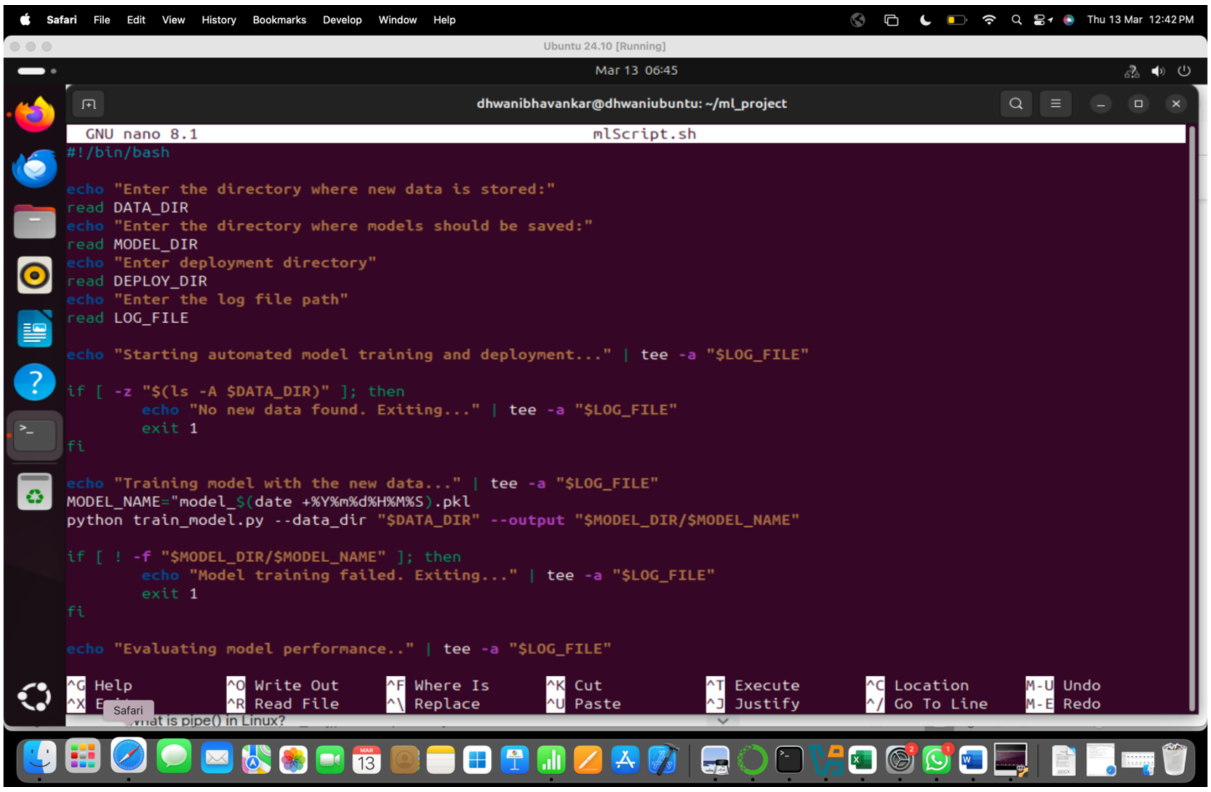
```
dhwanibhavankar@dhwaniubuntu:~$ cat state.txt
cat: state.txt: No such file or directory
dhwanibhavankar@dhwaniubuntu:~$ touch state.txt
dhwanibhavankar@dhwaniubuntu:~$ cat state.txt
dhwanibhavankar@dhwaniubuntu:~$ mkdir -p ~/ml_project && cd ~/ml_project
dhwanibhavankar@dhwaniubuntu:~/ml_project$ sudo apt install -y python3-venv
[sudo] password for dhwanibhavankar:
Installing:
  python3-venv

Installing dependencies:
  python3-pip-whl  python3-setuptools-whl  python3.12-venv

Summary:
  Upgrading: 0, Installing: 4, Removing: 0, Not Upgrading: 25
  Download size: 2,598 kB
  Space needed: 2,946 kB / 4,314 MB available

Ign:1 http://ports.ubuntu.com/ubuntu-ports oracular-updates/universe arm64 python3-pip-whl all 24.2+dfsg-1ubuntu0.1
Ign:2 http://ports.ubuntu.com/ubuntu-ports oracular/universe arm64 python3-setuptools-whl all 74.1.2-1
Ign:3 http://ports.ubuntu.com/ubuntu-ports oracular-updates/universe arm64 python3.12-venv arm64 3.12.7-1ubuntu1.1
Ign:4 http://ports.ubuntu.com/ubuntu-ports oracular/universe arm64 python3-venv arm64 3.12.6-0ubuntu1
Ign:1 http://ports.ubuntu.com/ubuntu-ports oracular-updates/universe arm64 python3-pip-whl all 24.2+dfsg-1ubuntu0.1
Ign:2 http://ports.ubuntu.com/ubuntu-ports oracular/universe arm64 python3-setuptools-whl all 74.1.2-1
Ign:3 http://ports.ubuntu.com/ubuntu-ports oracular-updates/universe arm64 python3.12-venv arm64 3.12.7-1ubuntu1.1
Ign:4 http://ports.ubuntu.com/ubuntu-ports oracular/universe arm64 python3-venv arm64 3.12.6-0ubuntu1
Ign:1 http://ports.ubuntu.com/ubuntu-ports oracular-updates/universe arm64 python3-pip-whl all 24.2+dfsg-1ubuntu0.1
Ign:2 http://ports.ubuntu.com/ubuntu-ports oracular/universe arm64 python3-setuptools-whl all 74.1.2-1
Ign:3 http://ports.ubuntu.com/ubuntu-ports oracular-updates/universe arm64 python3.12-venv arm64 3.12.7-1ubuntu1.1
Ign:4 http://ports.ubuntu.com/ubuntu-ports oracular/universe arm64 python3-venv arm64 3.12.6-0ubuntu1
Ign:1 http://ports.ubuntu.com/ubuntu-ports oracular-updates/universe arm64 python3-pip-whl all 24.2+dfsg-1ubuntu0.1
Err:2 http://ports.ubuntu.com/ubuntu-ports oracular/universe arm64 python3-setuptools-whl all 74.1.2-1
```


Finder File Edit View Go Window Help
Thu 13 Mar 12:43 PM
Ubuntu 24.10 [Running]
Mar 13 06:46
dhwanibhavankar@dhwaniubuntu: ~/ml_project
What is pipe() in Linux?

```
Error: Failed to fetch http://ports.ubuntu.com/ubuntu-ports/pool/universe/p/python3.12/python3.12-venv_3.12.7-1ubuntu1.
1_arm64.deb  Temporary failure resolving 'ports.ubuntu.com'
Error: Failed to fetch http://ports.ubuntu.com/ubuntu-ports/pool/universe/p/python3-defaults/python3-venv_3.12.6-0ubunt
u1_arm64.deb  Temporary failure resolving 'ports.ubuntu.com'
Error: Unable to fetch some archives, maybe run apt-get update or try with --fix-missing?
dhwanibhavankar@dhwaniubuntu:~/ml_project$ python3 -m venv venv
The virtual environment was not created successfully because ensurepip is not
available.  On Debian/Ubuntu systems, you need to install the python3-venv
package using the following command.

    apt install python3.12-venv

You may need to use sudo with that command.  After installing the python3-venv
package, recreate your virtual environment.

Failing command: /home/dhwanibhavankar/ml_project/venv/bin/python3

dhwanibhavankar@dhwaniubuntu:~/ml_project$ source v env/bin/activate
bash: v: No such file or directory
dhwanibhavankar@dhwaniubuntu:~/ml_project$ source venv/bin/activate
bash: venv/bin/activate: No such file or directory
dhwanibhavankar@dhwaniubuntu:~/ml_project$ pip install --upgrade pip
Command 'pip' not found, but can be installed with:
sudo apt install python3-pip
dhwanibhavankar@dhwaniubuntu:~/ml_project$ sudo apt install python3-pip
Installing:
  python3-pip

Installing dependencies:
  build-essential            libalgorithm-diff-xs-perl  libpython3-dev
  dpkg-dev                   libalgorithm-merge-perl    libpython3.12-dev
  fakeroot                   libdpkg-perl               libstdc++-14-dev
```


Finder File Edit View Go Window Help
Thu 13 Mar 12:43 PM
Ubuntu 24.10 [Running]
Mar 13 06:46
dhwanibhavankar@dhwaniubuntu: ~/ml_project
What is pipe() in Linux?

```
Error: Failed to fetch http://ports.ubuntu.com/ubuntu-ports/pool/main/p/python3-defaults/libpython3-dev_3.12.6-0ubuntu1
_arm64.deb  Temporary failure resolving 'ports.ubuntu.com'
Error: Failed to fetch http://ports.ubuntu.com/ubuntu-ports/pool/main/p/python3.12/python3.12-dev_3.12.7-1ubuntu1.1_arm
64.deb  Temporary failure resolving 'ports.ubuntu.com'
Error: Failed to fetch http://ports.ubuntu.com/ubuntu-ports/pool/main/p/python3-defaults/python3-dev_3.12.6-0ubuntu1_ar
m64.deb  Temporary failure resolving 'ports.ubuntu.com'
Error: Failed to fetch http://ports.ubuntu.com/ubuntu-ports/pool/universe/w/wheel/python3-wheel_0.44.0-1_all.deb  Tempo
rary failure resolving 'ports.ubuntu.com'
Error: Failed to fetch http://ports.ubuntu.com/ubuntu-ports/pool/universe/p/python-pip/python3-pip_24.2%2bdfsg-1ubuntu0
.1_all.deb  Temporary failure resolving 'ports.ubuntu.com'
Error: Internal Error, ordering was unable to handle the media swap
dhwanibhavankar@dhwaniubuntu:~/ml_project$ which python3
/usr/bin/python3
dhwanibhavankar@dhwaniubuntu:~/ml_project$ python3 --version
Python 3.12.7
dhwanibhavankar@dhwaniubuntu:~/ml_project$ pip3 --version
Command 'pip3' not found, but can be installed with:
sudo apt install python3-pip
dhwanibhavankar@dhwaniubuntu:~/ml_project$ apt install python3-sklearn
Error: Could not open lock file /var/lib/dpkg/lock-frontend - open (13: Permission denied)
Error: Unable to acquire the dpkg frontend lock (/var/lib/dpkg/lock-frontend), are you root?
dhwanibhavankar@dhwaniubuntu:~/ml_project$ touch mlScript.sh
dhwanibhavankar@dhwaniubuntu:~/ml_project$ nano mlScript.sh
dhwanibhavankar@dhwaniubuntu:~/ml_project$ chmod +x mlScript.sh
dhwanibhavankar@dhwaniubuntu:~/ml_project$ ./mlscript.sh
bash: ./mlscript.sh: No such file or directory
dhwanibhavankar@dhwaniubuntu:~/ml_project$ ls
mlScript.sh  venv
dhwanibhavankar@dhwaniubuntu:~/ml_project$ ./mlscript
bash: ./mlscript: No such file or directory
dhwanibhavankar@dhwaniubuntu:~/ml_project$ nano mlScript.sh
dhwanibhavankar@dhwaniubuntu:~/ml_project$ 
```


Safari File Edit View History Bookmarks Develop Window Help
Thu 13 Mar 12:42 PM
Ubuntu 24.10 [Running]
Mar 13 06:45
dhwanibhavankar@dhwaniubuntu: ~/ml_project
GNU nano 8.1
mlScript.sh

```
#!/bin/bash

echo "Enter the directory where new data is stored:"
read DATA_DIR
echo "Enter the directory where models should be saved:"
read MODEL_DIR
echo "Enter deployment directory"
read DEPLOY_DIR
echo "Enter the log file path"
read LOG_FILE

echo "Starting automated model training and deployment..." | tee -a "$LOG_FILE"

if [ -z "$(ls -A $DATA_DIR)" ]; then
        echo "No new data found. Exiting..." | tee -a "$LOG_FILE"
        exit 1
fi

echo "Training model with the new data..." | tee -a "$LOG_FILE"
MODEL_NAME="model_$(date +%Y%m%d%H%M%S).pkl
python train_model.py --data_dir "$DATA_DIR" --output "$MODEL_DIR/$MODEL_NAME"

if [ ! -f "$MODEL_DIR/$MODEL_NAME" ]; then
        echo "Model training failed. Exiting..." | tee -a "$LOG_FILE"
        exit 1
fi

echo "Evaluating model performance.." | tee -a "$LOG_FILE"
```