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Lab Manual

Create a Threat Model for a Healthcare AI System

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Lab 35 - Create a Threat Model for a Healthcare AI System

Task Description

You will simulate a simple threat modeling scenario for a Healthcare AI system that predicts whether a patient has diabetes based on input data (like age, weight, sugar level).

We will simulate:

- Data input stage
- Risk assessment
- Simple STRIDE mapping

Steps to create a Threat Model for a Healthcare AI System

1. Visit the link: https://colab.google/

2. Click on ‘New Notebook’

3. Start typing the code given below

    a. ***Installing the libraries***

```
# Required installations:
!pip install graphviz pandas matplotlib
```

    b. ***Code to create a threat model and performing visualization***

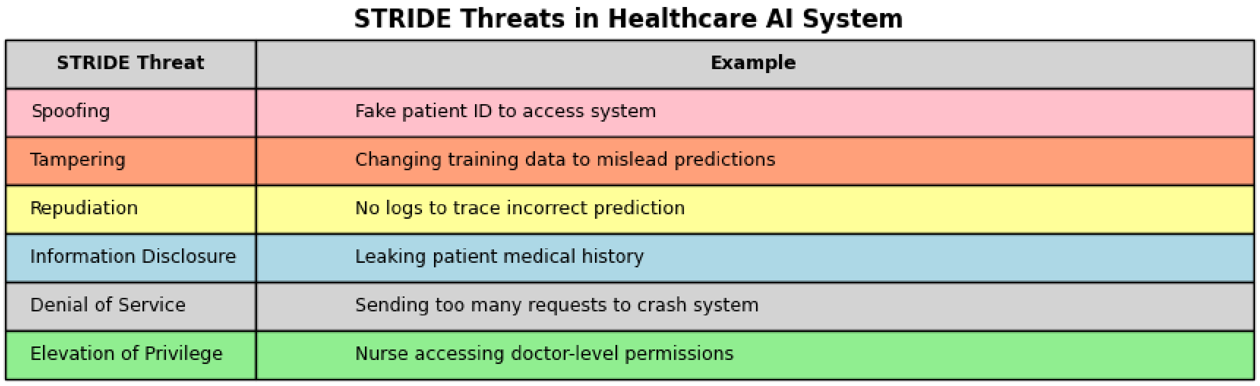
```
# Required installations:
# pip install graphviz pandas matplotlib

from graphviz import Digraph
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib.table import Table
from PIL import Image

# Step 1: Define ML pipeline
ml_pipeline = {
   "Data Collection": "Patient health data (age, weight, sugar level)",
   "Preprocessing": "Cleaning and normalizing data",
   "Model Training": "Train decision tree model",
   "Deployment": "Web API for predictions",
   "Inference": "User inputs -> predictions"
}
```

```
# Step 2: STRIDE threats with color codes
stride_threats = {
    "Spoofing": {
        "Example": "Fake patient ID to access system",
        "Color": "#FFC0CB"  # Light pink
    },
    "Tampering": {
        "Example": "Changing training data to mislead predictions",
        "Color": "#FFA07A"  # Light salmon
    },
    "Repudiation": {
        "Example": "No logs to trace incorrect prediction",
        "Color": "#FFFF99"  # Light yellow
    },
    "Information Disclosure": {
        "Example": "Leaking patient medical history",
        "Color": "#ADD8E6"  # Light blue
    },
    "Denial of Service": {
        "Example": "Sending too many requests to crash system",
        "Color": "#D3D3D3"  # Light grey
    },
    "Elevation of Privilege": {
        "Example": "Nurse accessing doctor-level permissions",
        "Color": "#90EE90"  # Light green
    }
}

# Step 3: Visualize ML Pipeline using Graphviz
dot = Digraph(comment='ML Pipeline for Healthcare')
dot.attr(rankdir='LR', size='10,5')

for stage, asset in ml_pipeline.items():
    dot.node(stage, f"{stage}\n{asset}", shape='box', style='filled', fillcolor='lightblue')

stages = list(ml_pipeline.keys())
for i in range(len(stages) - 1):
    dot.edge(stages[i], stages[i + 1])

# Render and show the pipeline image
dot.render('ml_pipeline', format='png', cleanup=False)
Image.open('ml_pipeline.png').show()

# Step 4: Visualize STRIDE threats with color-coding using matplotlib
fig, ax = plt.subplots(figsize=(11, 3))
```

```
ax.set_axis_off()
table = Table(ax, bbox=[0, 0, 1, 1])

# Table column headers
columns = ["STRIDE Threat", "Example"]
n_rows = len(stride_threats)
n_cols = len(columns)
widths = [0.2, 0.8]

# Add table headers
for col_index, column in enumerate(columns):
    cell = table.add_cell(0, col_index, widths[col_index], 0.2, text=column, loc='center', facecolor='lightgray')
    cell.get_text().set_fontweight('bold')

# Add table rows
for row_index, (threat, details) in enumerate(stride_threats.items(), start=1):
    table.add_cell(row_index, 0, widths[0], 0.2, text=threat, loc='left', facecolor=details["Color"])
    table.add_cell(row_index, 1, widths[1], 0.2, text=details["Example"], loc='left', facecolor=details["Color"])

ax.add_table(table)
plt.title("STRIDE Threats in Healthcare AI System", fontweight='bold')
plt.show()
```

4. Now click on ***Run All*** or ***Ctrl + F9*** to run all the cells

Output:



STRIDE Threats in Healthcare AI System

STRIDE Threat	Example
Spoofing	Fake patient ID to access system
Tampering	Changing training data to mislead predictions
Repudiation	No logs to trace incorrect prediction
Information Disclosure	Leaking patient medical history
Denial of Service	Sending too many requests to crash system
Elevation of Privilege	Nurse accessing doctor-level permissions

Explanation

STRIDE Threat	What it Means	Example in the Table	Color
Spoofing	Someone **pretends to be someone else** to trick the system.	Fake patient ID to access system	Light Pink
Tampering	**Changing data or code** so that the system behaves wrongly.	Changing training data to mislead predictions	Light Orange
Repudiation	**No proof or logs** of who did what, so no one can be held accountable.	No logs to trace incorrect prediction	Light Yellow
Information Disclosure	**Leaking private information** to the wrong person.	Leaking patient medical history	Light Blue
Denial of Service	**Flooding the system** with requests so that it **crashes or becomes very slow**.	Sending too many requests to crash system	Light Grey
Elevation of Privilege	Someone **gets more access** than they are allowed — like breaking into admin or doctor features.	Nurse accessing doctor-level permissions	Light Green

This visual helps you:

- **Understand security risks** in a healthcare AI system.
- **Relate each threat to a real-world example**.
- **Visually separate threats** using colors.