**C951 Task 3**

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C951-Machine Learning Project Proposal

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**A. Project Overview**

The AI-based system we are proposing will help combat the trafficking of drugs, weapons, and humans that the world is currently facing. Using image recognition at borders, ports, and multiple entry checkpoints can help lawful officials quickly stop the flow of illegal drugs, weapons, and human trafficking.

**A.1. Organizational Need**

Our organization works closely with federal and local law enforcement agencies

by providing surveillance with mounted cameras and drones. Equipping these monitoring systems with AI functionality will help them perform at a higher level to combat the current illegal activities at borders.

**A.2. Context and Background**

Our company has a long-standing history of working with local and federal government agencies and providing them with high-quality equipment and service. Upgrading our surveillance systems with AI image recognition will help save lives and combat crime in our country. Also, implementing this system will help with the current personnel shortage and not force an extra workload on current law officials.

**A.3. Outside Works Review**

The U.S Customs and Border Protection are using AI at the Canadian border from New York to Michigan, which stretches some 360 miles. NBRVSS (Northern Border Remote Video Surveillance System) can detect and monitor vessels miles away and inform agents of irregular vessel behavior. Our AI surveillance system will use similar technology and will have the same distance capabilities as the NBVRSS. (Koscak, P., 2022)

The organization Elbit uses AI for fiber optic-based ground systems, which can detect different vibrations and determine whether they are human. They also deploy Integrated Fixed Towers (IFT) along parts of the southwest border. With pinpoint accuracy, these advanced camera systems can spot drug smugglers or human traffic from miles away. We can observe how Elbit uses cameras and motion detection from underground cables to detect moments. We can implement another source similar to this method by equipping our drones with reflective lasers, but instead of detecting vibrations, it will show the shape of targets. (Hartley, A., 2020)

This AI technology is not just for stopping criminal activity at the border but is used to save lives. In an article from Border Report, Autonomous Surveillance Towers have saved thousands of immigrants' lives by pinpointing locations and predicting dangerous routes they may try to cross. With our AI systems installed at these borders, we can also save lives. Once risk assessments have been determined on targets, personnel can prepare with medical or special extraction equipment to help save lives. (Resendiz, J., 2022, March 26)

**A.4. Solution Summary**

Our AI system will decrease the criminal activity at borders by using multiple technologies and techniques. Our camera surveillance will not only be able to detect these people or vehicles at a long distance but be able to pick up on patterns of where and when illegal border crossings make take. The use of are drones will be able to run these predicted hotspots and even check for change of landscapes during patrol sessions.

**A.5. Machine Learning Benefits**

With the growing need for personnel and funding at borders, AI can help alleviate this by performing tasks that humans may take longer or are just incapable of doing. With this AI technology, borders will be more secure and cut down on the trafficking of drugs, weapons, and humans.

**B. Machine Learning Project Design**

**B.1. Scope**

**In Scope:**

* Installation of camera surveillance systems at current locations.
* Drones equipped with AI capabilities to track and locate illegal activities.
* These systems will help stop and deter illegal activities at borders by collecting data on current hot spots located on the borders. This AI system can use current data at several other sites of newly installed equipment.

**Out of Scope:**

* Will not provide personnel to monitor cameras or control drones. Trainers will be provided to train current employees.

**B.2. Goals, Objectives, and Deliverables**

Goals

* Create an AI system will help combat illegal activities at borders.

Objectives

* These AI algorithms will be able to detect suspicious activity and determine a risk percentage for an interception from previous gather data.
* Personnel will be trained to monitor and operate this AI system.

Deliverables

* A new AI system that collects surveillance data to stop, deter, and predicate illegal activities at borders.

**B.3. Standard Methodology**

Development will follow the SEMMA methodology

* Sample: Gather data from the newly installed AI systems and any other previous surveillance data of odd moments and terrain changes. We will need to gather at least 20,000 per location. We also collection information from current employees on what would be suspicious activity.
* Explore: We will go through this collected data and determine if there would be any issues that the AI system may encounter. One of these issues could be detecting the difference between animals and humans. Another could be how weather affects the AI systems when monitoring.
* Modify: Once this data is collected, surveillance and images that produce a 95% positive detection rate will be used, and the rest discarded. The discarded surveillance and image will be scanned and used to keep positive detection above 95%.
* Model: Once the positive detection rate has been achieved, the AI system will be structured to meet that requirement continuously.
* Assess: Once the AI is trained and operational, accuracy will be verified but doing mock scenarios to demonstrate its detection and risk assessment capabilities.

**B.4. Projected Timeline**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sprint** | **Start** | **End** | **Tasks** |
| 1 | 08/01/2022 | 08/01/2022 | The proposal for the project is accepted |
| 2 | 08/02/2022 | 08/12/2022 | Presentations with demos begin development |
| 3 | 08/15/2022 | 08/15/2022 | Demos and presentations are presented to customer |
| 4 | 08/16/2022 | 08/19/2022 | Address any concerns or question from customer before installation |
| 5 | 08/22/2022 | 09/02/2022 | Begin installation of camera systems and drones at priority locations |
| 6 | 09/06/2022 | 10/21/2022 | Installation finish and begin development of the AI system |
| 7 | 10/24/2022 | 10/28/2022 | AI system complete and data samples have been collected, begin mock training with scenario base cases |
| 8 | 11/01/2022 | 11/11/2022 | Confirm accuracy from training scenarios, adjust as needed |
| 9 | 11/14/2022 | 01/03/2023 | Deploy systems to all locations |

**B.5. Resources and Costs**

|  |  |  |
| --- | --- | --- |
| **Resource** | **Description** | **Cost** |
| Labor hours including third party workers | Estimated labor cost for installation and developers | $275,000 |
| Materials | Drones, towers, cameras, and servers | $15,000,000 |
| Material transportation | Delivering equipment to sight | $60,000 |
| AI Software | The provided software created | $250,000 |
|  | **Total** | $15,585,000 |

**B.6. Evaluation Criteria**

|  |  |
| --- | --- |
| **Objective** | **Success Criteria** |
| Ease of Use | All qualified employees will be trained and operate the systems confidently |
| Detection Percentage | AI system is at a 95% detection rate |
| Start and Restart | System can withstand a power failure and start backup with no issues |

**B. Machine Learning Solution Design**

**C.1. Hypothesis**

Our borders have seen increased illegal activity, such as drugs, weapons, and human trafficking. We feel that our AI system can help stop many illicit activities at these borders and save lives.

**C.2. Selected Algorithm**

The Faster Region-Based Convolutional Neural Networks (Faster R-CNN) algorithm that uses a Region Proposal Network (RPN) would be used for task detection

**C.2.a. Algorithm Justification**

This algorithm will allow our AI system to predict images at 0.2 seconds, which is necessary for live environments. This algorithm will enable more effective and precise decision-making for personnel on the ground.

**C.2.i. Algorithm Advantage**

The Faster R-CNN uses convolutional computations that are shared across the network. This means that filters that are used to predicate the image are tasked across the network and can take advantage of multiple computations for this single task.

**C.2.ii. Algorithm Limitation**

The drawback with the Faster R-CNN is training time for accuracy. Since this algorithm breaks down a picture to several anchors, this requires large amounts of data sets to be accurate.

**C.3. Tools and Environment**

Java will be used as the programming language due to its sizeable informational base and longevity in the programming world. In addition, a programming language can implement Java on many different platforms, meaning less coding time. We will use the Ubuntu operating system for two main reasons: 1. The ease of controlling and installing updates throughout the project. 2. Make upgrading hardware easier because of no complex restriction policies.

**C.4. Performance Measurement**

When the AI system begins training, we will only provide quality surveillance videos and images. These quality checks of data will increase its ability to be more accurate and keep anomalies down. For the system to be considered accurate, detection must maintain a minimum of 95%. If it goes below this percentage, the data causing authentic issues will be removed when cleaning data.

**D. Description of Data Sets**

**D.1. Data Source**

Our company will use historic surveillance and image data from current systems. In addition, we will source the data collected from previous customers and jobs. Finally, if additional data is required, we will source it through a third party to provide us with that data. However, this will occur additional costs.

**D.2. Data Collection Method**

Data will collection from the customer servers as well as ours. Third party collection would only be used if needed.

**D.2.a.i. Data Collection Method Advantage**

The data collection method will provide us and our AI system with all the required information to provide a successful strategy for our customers.

**D.2.a.ii. Data Collection Method Limitation**

This collection method could be very labor intensive and require more time to reach our goals. If this slows the project to an unacceptable launch, negotiations with a third party would be necessary but would increase costs.

**D.3. Quality and Completeness of Data**

Before data is used to train our AI system, we will filter through surveillance videos and images for low-quality and disrupted images. This data would be removed from the data set to feed our AI system. This insufficient data set can train our AI to remove or ignore this insufficient data. After several runs, we can use the clean data sets to narrow down any data anomalies

**D.4. Precautions for Sensitive Data**

Since this project requires working or large amounts of sensitive data, all employees must have secret clearance to install equipment. In addition, employees working with and training the AI system will require top-secret clearance. Finally, any third-party agencies brought on board must have the same clearances.

**References**

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