

# SmartState



## Team Members:

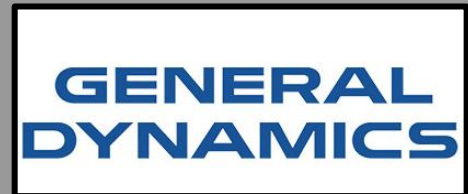
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Reed Hayashikawa, Jianxuan Yao,  
Jesse Rodriguez

## Project Mentor:

Fabio Santos

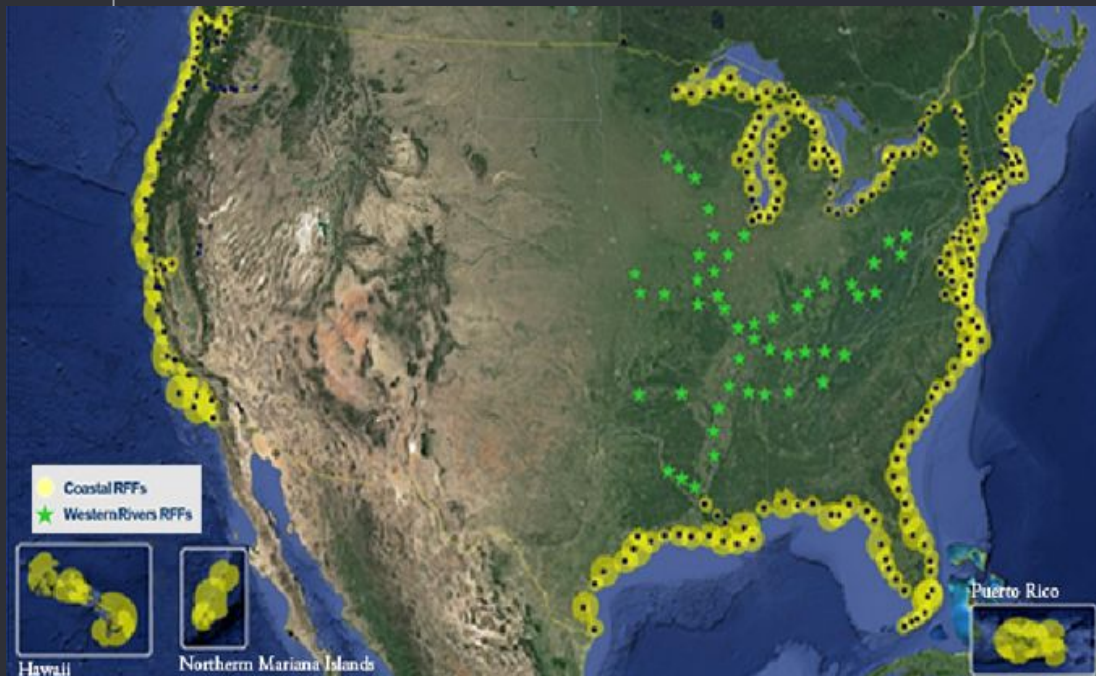
## Sponsors:

Aaron Childers (System Engineer)  
Jon Lewis (System Engineer)

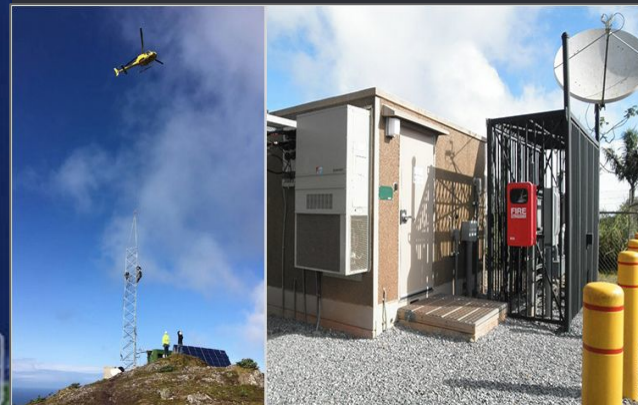


# Domain: Coast Guard

## 21ST CENTURY SEARCH AND RESCUE SYSTEM



Communication Towers



# Ticket System

## WHAT IS IT?

Communication and Tracking System

Utilized by the Coast Guard

Maintained by General Dynamics

## Error Reporting System

- Tickets tell a story of how the system failed.
- 20-30 per month

## Current Process of Resolution:

- FRACAS team members analyze tickets by hand
- Classify each ticket individually

The screenshot displays a web-based ticket management interface. At the top, there are several tabs and a search bar. The main content area is a form with the following fields and sections:

- Incident ID:** A text input field.
- Region:** A dropdown menu with 'Region' selected.
- Problem Summary:** A large text area containing the text 'Reliable Reports'.
- Resolution Summary:** A large text area containing the text 'Troubleshooting Summary'.
- System Date:** A date field.
- System Classification:** A dropdown menu.
- Relationship:** A dropdown menu.

At the bottom of the form, there are several buttons: 'Save', 'Cancel', and 'Print'.

# Classification Process: Current

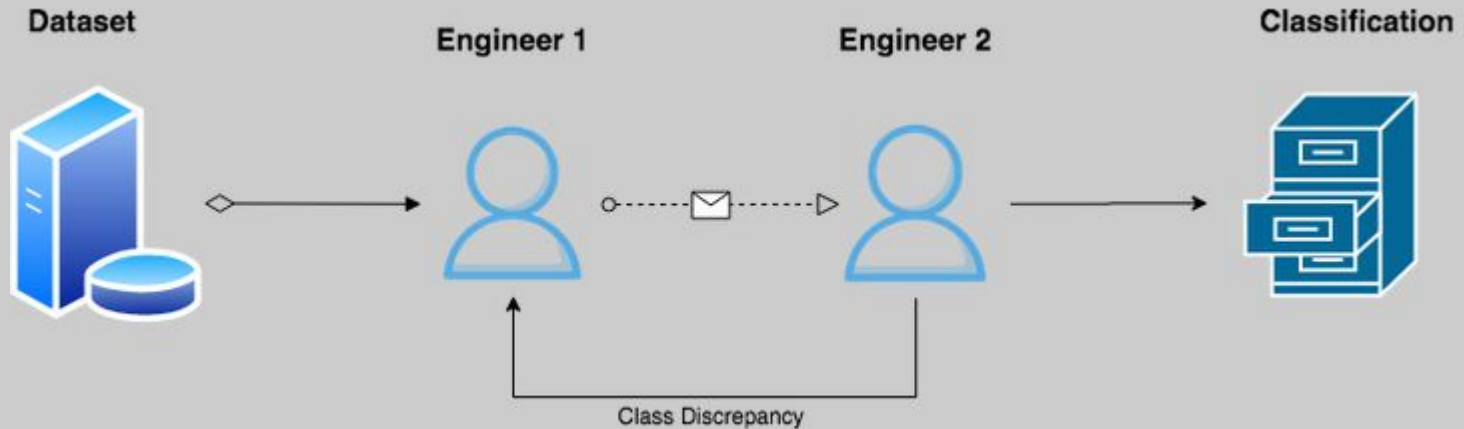
## Team of Two Engineers:

- Pull a **single ticket** from dataset
- **Engineer 1** - classifies ticket, passes it to Engineer 2
- **Engineer 2** - confirms or challenges
  - Confirms: Ticket is archived with classification
  - Challenged: Ticket is returned to Engineer 1 and reclassified

## Time:

- 10 minutes per Engineer
- **At the Least:** ~20 Min
- **At the Most:** ~ 30 Min

# Classification Process: Current



# • Solution: Emelia

## Envisioned Solution:

- Event-driven Machine Learning Intelligent Assessor (EMELIA) that will be able to effectively analyze and classify system failures.

## EMELIA will:

- Extract data
- Class prediction by Neural Network
- Produce system/data metrics
- Significantly decrease

# Solution: Emelia

**Ticket Dataset**



**EMELIA**



**Classification**



**System Metrics**

# • Requirements

## ○ Key Functional Requirements:

- Classify input data
- Process data provided for training
  - Convert CSV data to OneHotEncoded values
  - Pass the input to a neural network
- Automate evaluation of learning model accuracy by comparing predictions to test data set



# • Requirements cont.

## ○ Reliability

- Development team will need to ensure ticket data is correctly assigned to labels provided

## Scalability

- Model should be able to train on comprehensive history of ticket data
  - Based on database queries

## Maintainability

- Modularize our program for long term use by the client
  - Pipeline of functionality

# Implementation Overview

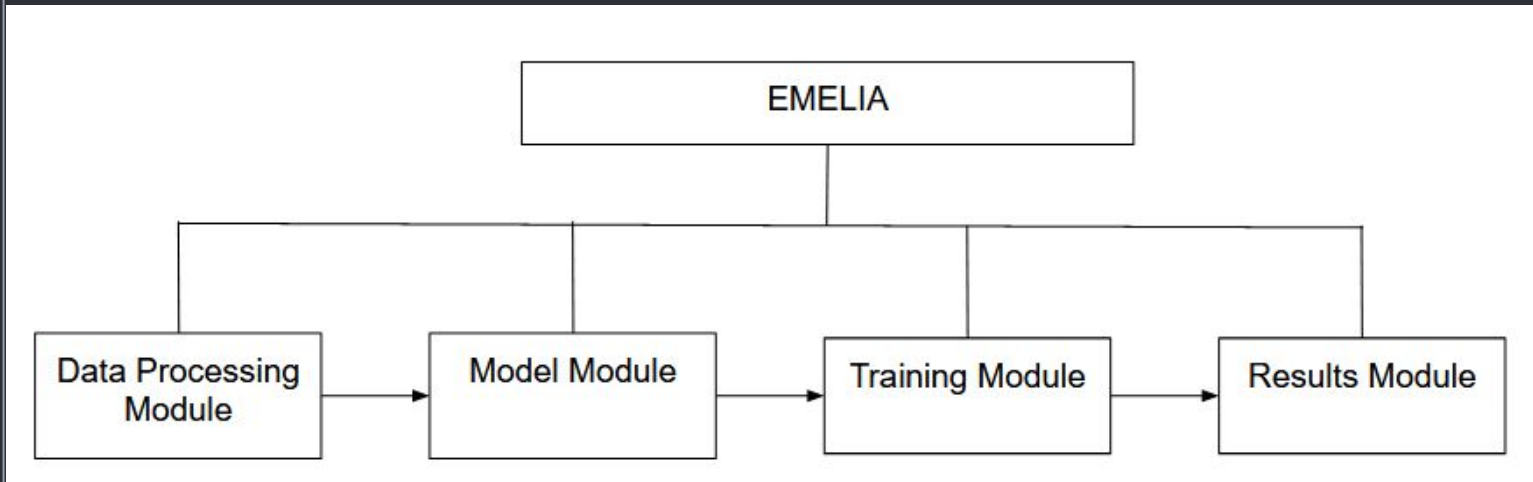
## Technologies

- Python
- TensorFlow
  - Keras API
- Conda Environment with specified dependency versions

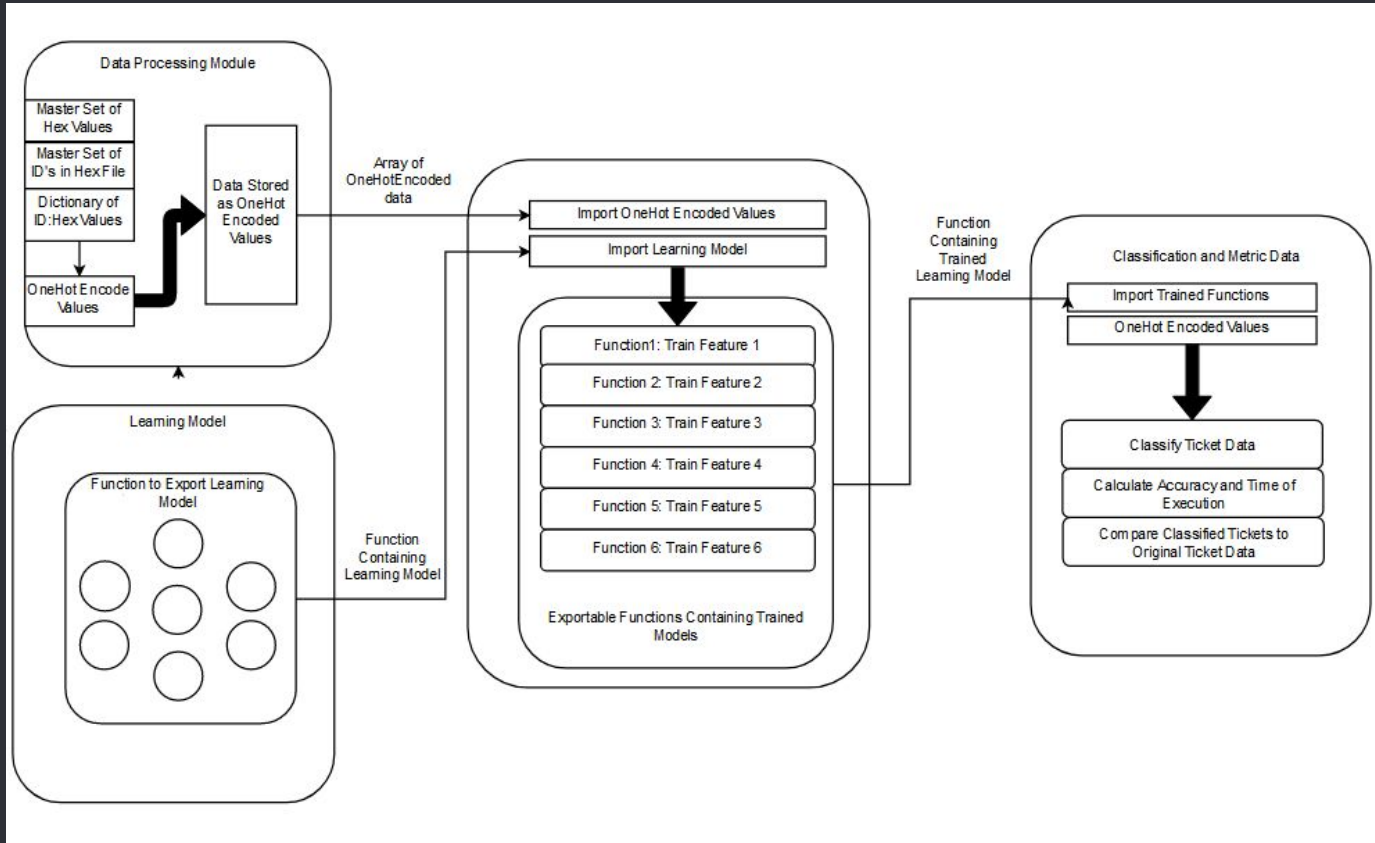
## Architecture

- Data pipeline that provides functionality downstream

# Implementation Overview



# Architectural Overview

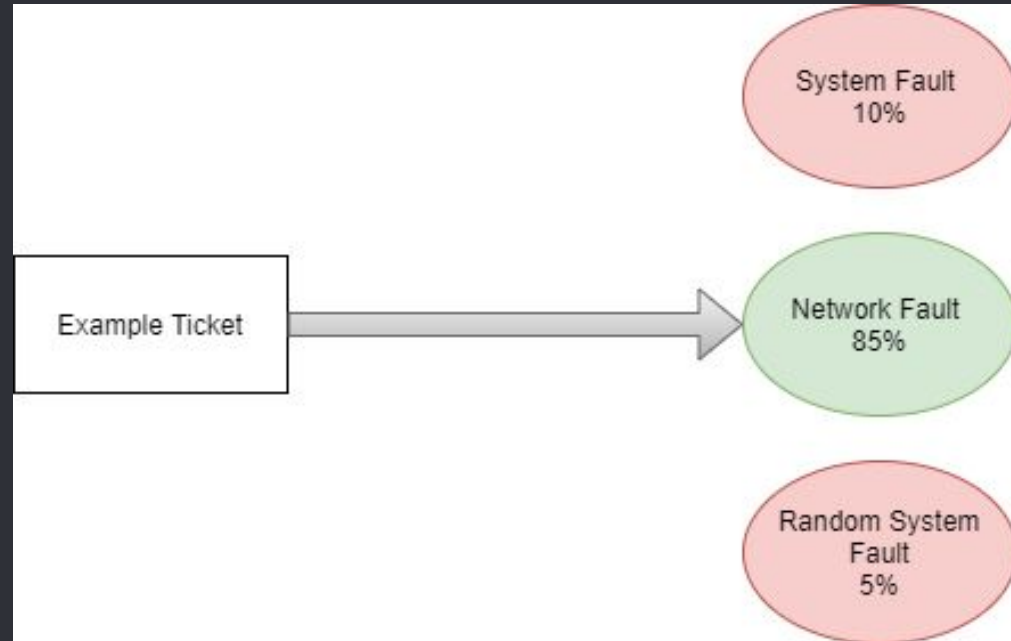


- Challenge 1:  
Accuracy Dependency on Training Data

Solution:

Train the neural network with more evenly distributed data

- Challenge 2: Ensuring Correct Classification



Solution:

Implementing a confidence threshold

# Schedule

February 2020

12 13 14 17 18 19 20 21 24 25 26 27 28 02 03 04

Activity	Start	End	
<b>Phase One</b>	<b>19-02-20</b>	<b>04-03-20</b>	<b>Data Formatting Phase</b>
Improve Readability	24-02-20	04-03-20	Andrew
Refactor Data Processing	24-02-20	04-03-20	Team
<b>Phase Two</b>	<b>20-02-20</b>	<b>04-03-20</b>	<b>Learning Model Phase</b>
Implement Accuracy Threshold	20-02-20	04-03-20	Reed
Testing and Refactoring	25-02-20	04-03-20	Yao
Create Remaining Neural Network Structure	26-02-20	04-03-20	Team
<b>Phase Three</b>	<b>26-02-20</b>	<b>04-03-20</b>	<b>Output Metrics</b>
Create Command Line Tool	26-02-20	04-03-20	David
Driver Program Structure	28-02-20	04-03-20	Andrew
Create Test Suite	26-02-20	04-03-20	Jesse
Finalize Complete Prototype	02-03-20	04-03-20	Team

# Conclusion

## BIG PICTURE:

General Dynamics error reporting process depends solely on manual review of tickets for ticket classification.

EMELIA will assist in the ticket classification process.

Our software will improve the Coast Guard's responsiveness to life endangering events by increasing the accuracy and efficiency of our clients error reporting system.





Questions?