AIA Maneuver Identification

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Overview

The U.S. Air Force released a dataset from Pilot Training Next (PTN) through the AI Accelerator of Air Force pilots and trainees flying in virtual reality simulators. In an effort to enable AI coaching and automatic maneuver grading in pilot training, the Air Force seeks to automatically identify and label each maneuver flown in this dataset from a catalog of around 30 maneuvers. The data provided has many dimensions with continuous classification problems and subtle boundaries. This project will aim to identify subsets of flight data with intervals along which a maneuver is performed as well as providing an aviation relative index of similarity to the “optimal form” for that maneuver. Additionally, in doing so, we hope to also lay the foundations for extending our work to real time identification.

Motivation

AI algorithms that identify maneuvers from trajectory data could play an important role in improving flight safety and pilot training. The Maneuver Identification (ID) Challenge has the potential to enhance and personalize simulator training by providing mid-flight and post-flight feedback to students. As there continues to be a large pilot shortage, improving technologies to individualize and automate some aspects of training present an opportunity to alleviate the burden of training. Further refinement and exploration of real time maneuver identification may be useful in safety and warning systems for private aircraft.

Source/Data Set

Source: Motivation | AIA Maneuver Identification (mit.edu)
Data: Data | AIA Maneuver Identification (mit.edu)
Info: 2.89GB/6,661 files of .tsv files containing aircraft positional/orientation over various intervals

Goals

1. Clean, prepare and label the data
2. Sort and Classify the data into good/bad examples
3. Identify time intervals of maunvers vs steady flight
4. Grade Maneuvers based on a scale that accounts for safety and allowable tolerance of variations

Challenges

1. Unlabeled dataset with noise and incorrect data translations
2. Indistinct categories dependant over time
3. Large number of dimensions and aircraft states

Methods

I. Manual Identification and Baseline

Create a visualizer of the data so that results can be verified and a small subset can be labeled for testing. Additional domain research will be required to set flexible parameters around categorizations and grading scales.

II. ML Algorithms

We plan to compare two different machine learning implementations to see how they perform for classifying flight maneuvers from the data. The first will be a kNN classifier using Dynamic Time Warping as the distance measure between two sequences. The second method will be a neural network implementation. The input to the neural network model will be a feature vector constructed from each maneuver consisting of features such as average change in pitch, roll, and yaw across the maneuver.