Statistical Learning Project

1st Milestone

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Research Title

Abstract

Develop an AI agent able to play an FPS Aim Trainer game, in different scenarios.

Main research aim & framework

We have been fascinated for years by real-time image processing, and we are interested in carrying out agent-based (human action mimicking) ML projects, for which we are able to observe and qualitatively assess model performance and quality. We have already developed another task (on a smaller scale, but similar in spirit) during our Bachelor (for which, however, data collection was much more guided and easy..) and we really enjoyed it.

Generally speaking, our agent will have to observe what is displayed on the computer screen and react in real time by properly moving the mouse cursor and possibly clicking some key buttons. Fully developed software packages having an analogous aim are widely spread nowadays (they might be addresses as some kind of "eSports doping"), but they are mostly “injection aimbots”: game-specific and utilize non-visual features and data (normally hidden to the player). Our aim would be to instead develop a game-agnostic agent, exploiting only visual information (i.e., screen pixels color values) as features to make decisions, and assess the level of performance achievable.

Furthermore, we would like not to rely on explicit object recognition models: there are already plenty of such pre-trained models available online (c.f., “Tensorflow CSGO Aimbot”, https://youtu.be/gIVbY8Ni88U), which accomplish the job rather fine, but in a conceptually different way. Specifically, game-related knowledge is oftentimes considered in order to fix entities dimensions, and ML use is limited to identification of objects and does not extend to mouse movements (which are determined naively according to targets positions). In our project, following the game-agnostic approach, we would like to associate each computer screen state with a (vectorized) mouse movement.

IML paper(s) you like (at this point!)

- Ribeiro et al., "Why Should I Trust You?": Explaining the Predictions of Any Classifier
- Vermeire et al., Explainable image classification with evidence counterfactual - pattern analysis and applications

Both the papers present several methods that might help us understanding which are the image features that will drive decision of our future model.

Data source(s) + Software/Hardware Toolkit

Python libraries and Windows API to capture screenshots and mouse movements/clicks. If really needed (due to computational/latency issues), we could rely on Screen Recording software and external hardware, like Capture Card devices.

Data collection

We plan of playing the FPS Aim Trainer game (yet to be decided, e.g. www.3daimtrainer.com/) and collecting data points, consisting of [screenshot + mouse position + click state] multiple times per second. In principle, we could generate data at will, playing the game for hours; realistically, we would collect an initial small dataset and perform data-augmentation techniques on it. Mouse inputs are just recorded as strings (lightweight), while images could require more storage space (depending on the chosen resolution). The main difficulty we can foresee is in the computational capabilities of the computer machines at our disposal to collect individual data points with a high enough frequency as to allow an accurate analysis; we believe we won't encounter significant problems, but eventually we could try to build up a dataset by implementing a hybrid approach consisting in mixing video recording and mouse input stream separately.

Model & Methods

Given the input data, the output of the model would consist of [mouse movement + a binary value for the click state].

As of now, we think it might be possible to model the problem as a classification or a hybrid classification/regression one. The classification would be needed to decide whether to shoot or not, and the direction (possibly the module, depending on the specific modelling tools adopted) of the movement vector could be determined by regression (angle, size..) or classification (given a range of possible choices) outputs.

The IML papers selected might provide the tools needed to analyze the results and even potentially help us identifying wrong features and patterns picked up by the model.

References

See .bib file uploaded on Moodle