AiPerCog - Understanding AI Players By Modelling Real Players' Personality

A Data Management Plan created using DMPTuuli

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Project abstract:

AI will soon be influential throughout technological society, from transport to healthcare, civil engineering to defense. However, AI has developed such that it is often very hard to understand how and why it makes decisions - AI algorithms are a black box. Examples of what can happen when AI runs amok include recent self-driving car accidents and Boeing aircraft tragedies. Therefore, understanding AI decision-making processes is increasingly urgent for a sustainable society, and for science. A major difficulty in understanding AI decision making is how it differs from human cognition. To address this problem, we propose using online multiplayer games as an effective way to model and study AI decision making. In games, both human and AI agents are constrained by the same set of rules. Thus, AIPerCog is a perfect synergy in the study of digital and human realities. AIPerCog combines computer science methodologies, cognitive science, and humanistic/psychological game culture studies, to examine how AI develops to interact with and against humans. Video games and eSports are a growing cultural segment where both human and AI behaviours can be analysed from existing datasets of millions of game-plays. These large game-behaviour datasets, paired with existing open-source game-playing AI and our novel player modelling algorithms, provide a powerful testbed to study AI-human interaction. Games research as a field exemplifies the digital humanities paradigm: here, AI is not a purely engineering challenge, as designing for interacting with humans requires understanding of human mind, behavior and culture. AI agents that learn to play at a top level have been seen to use totally novel winning strategies. Such unpredictable strategic moves, going against all common wisdom, were made in the game of Go by the famous AlphaGo algorithm; and in real time strategy games by AlphaStar. This harmless scenario illustrates the need to rigorously examine and contrast AI vs human behaviour, to act as "a canary in the coal mine" for AI applications of future societies. This project will develop and advance the principle of cognitive transparency of human & AI players, and thus help us understand and control the strategic decision-making processes of complex AIs. The proposed research aligns with the University of Helsinki strategic research area "The Human Mind in a Changing World"; plus Academy of Finland's Center of Excellence "Game Culture Studies", and the Flagship FCAI.

Last modified: 04-09-2019

relationship to, your project or proposal

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1. General description of data

What kinds of data

We use mainly questionnaires and behavioural data from game players.

Questionnaires consist of surveys on player preferences and motivations to play, plus background data, for validation datasets.

Behavioural data is the log of individual actions within a game, defined as activity-related variables of sufficient detail that complete games can be replayed, given a suitable game engine software.

Much of this data is already available either from online repositories, or from project partners. A smaller portion of validation data will be collected from recruited subjects, via a downloadable software platform.

Some portion of the replays available online, produced by eSports tournaments, can be linked to commentaries on the games given by domain experts (as in, sports commentaries). Tournament games can also be linked limited background data on the players themselves, such as name, age, gender, and competition history.

Gb	Datatype	Source	Format	Sensitive	controller
<5	Replays for testbed games	Live participants recruited online	*.SC2replay & *.json	No	Tampere
<1	Player personality questionnaires	Live participants recruited online	*.csv	No	Tampere
>10	StarCraft II game replays	Blizzard Games	*.SC2replay	No	Uni Helsinki
1-2	StarCraft II / Hearthstone tournament game replays	Various websites, e.g. lotv.spawningtool.com	*.SC2replay	No	Uni Helsinki
<1	StarCraft II / Hearthstone tournament game player background	Various websites, e.g. lotv.spawningtool.com	*.csv	No	Tampere
<5	StarCraft II / Hearthstone tournament game expert commentaries	Various websites, e.g. twitch.tv	*.mp3	No	Uni Helsinki
<5	Hearthstone public repo	hearthscry.com	*.json	No	Uni Helsinki
<1	Extensive survey responses on play styles & preferences	Vahlo+Kinrate Analytics, new survey participants	*.csv	No	Tampere

What data

The project collects data primarily from large open datasets of game-play recordings published online by games companies to promote research, and by eSports tournaments to promote their events. These are not always available as single repositories, so (where needed) we will gather them by web-scraping and curating from the sources. In addition, the project will collect game replays from state of the art AI agents released online (AlphaStar Team, 2019), and generate its own very large datasets of game replays produced by AI agents playing the testbed games.

To facilitate study of player personality, the project will have access to ~14000 respondents to surveys on player preferences and motivations to play completed by respondents from Finland, Denmark, Canada, Japan, USA, UK, Korea and Brazil (one of the largest datasets of its kind, gathered by post-doc Vahlo and his startup company Kinrate Analytics in 2014-2019). Further, in order to validate the modelling work, the project will gather game records for each testbed game, plus background data and psychological self-reports including playing personality tests, from at least 100 live subjects.

File formats and size estimate

Game replay and self-report / background data are in common open plaintext data formats, such as json, csv, or similar. Large datasets obtained online scale to tens of gigabytes of such data. Validation data (100+ subjects playing three games) will generate much less data, on the order of megabytes.

Audio files of tournament game commentaries are converted from online videos, typically saved in mp3 format. These files will take tens of gigabytes of storage.

We will use a relational database software to manage data organisation, version control, and access.

Online data sources are of consistent quality: game replays are created by the game engines themselves, programmed by the original game developer and tested by millions of users. Video/audio commentaries are produced at a professional standard equivalent to traditional sports reporting, with high consistency.

Protecting the identity of players who produce the data, by minimisation, pseudonymisation, and anonymisation will not affect data quality.

For the validation data gathered from live subjects, the project researchers have extensive experience from similar past recordings, and will use an automated platform to encapsulate data gathering. This means (a) we have extensive ability to plan failsafes, (b) we can run the data gathering for as long as needed to get the quantity, quality, and consistency of data we need.

2. Ethical and legal compliance

For data gathered from subjects, typical ethical procedures will be followed, including approval by an ethical review board (at one of the participating institutions), following guidelines of the Declaration of Helsinki, full briefing and informed signed consent. Such data will also be anonymised before publishing, and will only consist of forms of data which can and have been safely anonymised. The partner responsible for collecting data from live subjects is Tampere, whose Games Research Lab is performing similar research with similar data on a continuous basis, and thus very well equipped to manage the data safely and ethically. That institute will obtain the ethical permission needed immediately on being granted funding.

For online data gathered from open sources, the project will not use or share the data in any way not covered by the licence terms that already exist. Additionally, all such data will be analysed in anonymised form, such that identification of original individuals is not possible (either because the data has been anonymised at source, or by removing all identifiers prior to analysis).

Ownership, copyright and IPR issues

All sources of online data have been confirmed to provide explicit rights to use the data for research. For sharing such data as a project output, the original source will be identified and linked (rather than re-published).

Data recorded directly from live subjects, or produced by AIs, will be owned by the partner institutions of the AiPerCog project itself (Tampere and Helsinki respectively).

Agreements with all partners / researchers will be made in the beginning of the project to define issues of ownership and sharing of the data.

For sharing data, we will use MIT licence.

Restrictions

There are no restrictions that prevent the data being used and shared in the manner planned in the project.

3. Documentation and metadata

Data documentation

During the project, data will be managed by standard methods:

Metadata standards
Data management software, i.e. database
File naming conventions
Fixed directory structure
Readme file(s)
Version control

Filenaming conventions: All data will be identified with short, human-readable but anonymous keys, which contain following information.

- ID number unique to each human subject or AI agent
- Short text key for data type, e.g. SC2 for StarCraft2, or MOT1 for play motivations questionnaire 1
- Identifier for session number, e.g. match3 for 3rd match played by that individual

This system essentially allows each piece of data to be uniquely identified.

Datasets will be published with documentation describing the structure, licencing, and associated software resources (scripts for processing or analysis).

Metadata

Meta-data for the overall study will be formulated as a tabular database, organised congruently to the data itself. Thus the main key for data will be subject ID, linking to tables for each session (including trait data recording).

4. Storage and backup during the research project

Data will be stored on large-capacity server solutions provided by **CSC – IT CENTER FOR SCIENCE LTD.**, which provides high performance computing solutions that can be shared across project institutions. CSC also handles data backups.

The directory structure for data storage will then be sorted by subject ID. Into each subject ID folder, all subject-related data will be arranged in terms of meta-data, trait-wise background data, and session-wise data recordings.

Project data will be hosted on secure servers with access controlled by project PIs, and available only to project researchers. Identification of subjects will be even more tightly controlled, with the key to link individuals to their unique ID codes encrypted and accessible only by project PIs.

5. Opening, publishing and archiving the data after the research project

All data is envisioned to be publishable in different senses.

The large datasets already available online need only be identified/linked in our research reports. This will happen in the first few months of the project.

The project will be given permission by subjects whose data are recorded to share it in anonymised form. Their data will be available midway through the project.

Towards the end of the project, software scripts to process or analyse the data will be published in online

repositories, on Github.

Once the associated data is fixed (all recordings complete, all processing software finalised), meta-data will be published to the Etsin service.

The datasets from live subjects will be made available through online data respository Zenodo, receiving a permanent digital identifier.

For large third-party datasets, as a contingent measure, we can mirror those data on servers of the Game Culture Studies Centre of Excellence (without breaching any licence terms), to ensure they will not be removed in future.

n/a

6. Data management responsibilities and resources

Project PIs will be responsible for initial planning of the data management procedures. They will then delegate responsiblity for detailed implementation to their respective post-doctoral researchers, who handle design of the web-scraping software, the psychometric questionnaire software, and the software to encapsulate games for live data collection.

Finally, day to day data management tasks will be performed by post-graduate students. This is expected to take no more than 3h / week during 2-3 weeks before opening the data in a repository.