2018-00819 - Intelligent trajectory analysis in large dimensional spaces

Contract type : Public service fixed-term contract
Level of qualifications required : Graduate degree or equivalent
Fonction : PhD Position

Context
Within the framework of a partnership between the teams Mnemosyne and Flowers, we are working with the company Ubisoft, to consider using machine learning techniques in the domain of video games.

Context:
An intelligent system must be able to analyze the state and dynamics of its environment (including itself), in order to effectively solve problems. This sometimes involves manipulating and learning state sequences in very large spaces, which is a major challenge for today's Artificial Intelligence and automatic learning techniques.

This is particularly true in the field of video games where gaming spaces are endowed with increasingly rich environments and where the increasing diversity of potential actions of players and artificial agents makes the space of possibilities wider and wider. The systematic exploration of these spaces being most often impossible, a first challenge is to propose heuristics allowing to explore them "intelligently", i.e. with the best ratio between the time spent and the information collected. If it becomes affordable in off-line mode, this learning process makes it possible to build representations, sometimes called models of the world, which can then be used to propose adapted online responses.

Moreover, another current problem is to provide explanations and justify one's decisions, which is important for systems interacting with human users or designers of the considered environment.

Assignment

Project:
We propose to develop new learning algorithms with unsupervised and semi-supervised aspects, allowing to analyze sets of trajectories in very large spaces. The goal is to understand both how these trajectories are divided into different families to exploit certain contingencies linking the variables of these spaces and how they aim to achieve certain regions of space that may correspond to goals.

In the targeted field of application, the analysis of video games, the essential challenge consists in being able to better understand the general organization of the game phases and its goals, but also, for each player, to characterize her profile and her game strategy in order to be able to personalize the content that will be offered online.

We propose here to perform such profiling in an automatic way, combining Machine Learning methods allowing to process time series (in particular by using recurrent neural networks), and motivational systems models in direct link with neuroscience and psychology to better analyze the semi-supervised aspects.

Having a corpus of a player's games (in the form of suites of states whose description levels will be defined), we will study how these techniques can make it possible to analyze this corpus in order to:
- understand the "rules of the game" and learn to predict certain player actions
- predict, for a given player and according to her history, the areas of the environment she is likely to explore and the associated performances
- understand the player's evolution (the evolution of her learning)
- propose typologies of player profiles making it possible to generate classes finer than the profiles conventionally considered

Main activities

Work program:
- State of the art of sequence process ing models (eg LSTM, ESN) and motivational system models for the exploration of large data spaces.
- Interaction with the industrial partner, for the shaping of different corpus of games of several players.
- Development of models for learning and extracting time sequences in games, in large spaces.
- Development of models for learning and analysis of learning trends.
- Synthesis of this work for the analysis of player behaviour patterns. Proposals of game adaptation tracks exploiting this knowledge.

Skills

Skills sought:
Initial training in computer science, skills and experience in machine learning and data processing are highly desirable. An interest in neuroscience and bio-inspired modeling is a plus.

Benefits package

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities