Does Exploration Behaviour That is Based of (Human-Like) Curiosity Supplement AI Smartness?

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***Abstract*—The abstract goes here.**

I. Introduction

ARTIFICIAL intelligence (AI) in video games is very crucial when it's used as one of the main mechanics. Intelligent non-player characters (NPCs) are extremely hard to make due to the nature of it's complexity. The more complex it is the more outcomes developers will have to consider and the more problems will occur during development.

Explain curiosity - human behaviour often depends on person's intentions to explore. Why apply to AI? The aim of this paper is not to create curiosity-driven AI in Unreal Engine 4 (UE4), but to implement and test a particular behaviour and see how people react. Whether they like it or not, whether they think it behaves smart and etc. The aim of this implementation is to find a small nuance that can make the AI feel and act smarter.

Throughout the last 30 years researchers are trying to create intelligent AI using different methods and algorithms. Recent achievements in such are are really worthy of respect, for example, AlphaGo or OpenAI (citation required). AI in games, however, is used to create non-player characters (NPCs), which can be enemies, merchants, companions and a lot more. Some of the very complex algorithms, such as reinforcement learning (RL), deep Q-learning, curiosity-driven, evolution-based (add more or change) are being used in old games such as Atari as a test. However, due to specificity of games, it is not always the best solution. Depending on game's design, very simple methods can be used instead, or less complex than previously mentioned ones. As an example, Monte Carlo Tree Search (MCTS) became a common one to use after the success of the game F.E.A.R (i guess?) or Finite State Machine (FSM), which is also a very common one these days and is being used in most known games (citation required). Another widely spread technic is behaviour tree, which I'm going to use for this paper.

II. Related Work

The main focus of this paper is to (demonstrate) talk about a potentially valuable AI behaviour that is not complex yet efficient in demonstrating (implementing) smart AI. In Section III different AI implementation methods will be discussed, both complex and simple. Section IV will present (introduce) human's curiosity and discuss its importance towards one's willingness to discover and possibly relevant behaviour implementations to make smart AI. The testing material will be discussed in Section V, which will also include an explanation and use of Turing's test. Methodology and hypotheses will be reviewed in sections VI and VII respectively. The behaviour implementation will be made in Unreal Engine 4 (UE4) using our team's game for easier testing purpose as there will be enough assets to create a unique world which AI could be placed on.

- Explain the main focus of this paper
- Explain the testing subject I'm gonna use
- Briefly explain next sections
- Will be using my third year team project game to test the implementation on.

III. AI Evolution or AI Importance in Games

Different methods that are used in AI learning - reinforcement, evolution-based, q-learning, curiosity-driven, etc.

- Why is it complex and important?
- What does it help to achieve?
- Talk about Halo 2 AI (and maybe TF2 bots - research more)
- Talk about how simple implementations can be much more efficient than complex learning methods

Artificial intelligence has a big place in the modern world. Robots are being created to ease human's life, machines that can beat best players in the world in most complex games such as Go (cite AlphaGo). But AI in games is not created to overcome player's abilities. It's there to enhance player's experience, to make the game more engaging and fun to play. Therefore, other difficult problems are being solved, which may not fit well with AI used in real life, but they are still very valuable. Solving AI problems using games has become pretty common nowadays and is used for many areas as a testing purpose (possible citation here).

AI for games is mainly developed to increase player's engagement and satisfaction aspects (maybe more), give the ability to set the difficulty level, create a relationship between the player and NPCs and much more (get more potential citation here). However, some games use it differently. Some games want to present players with feelings such as frustration, fear, anger (and more/possible citation). It is designers' desire to create such feelings depending on the game itself, which proves the flexibility of AI for games.

AI importance in games

- What makes AI important in games?
- What does it help to accomplish in games? Satisfaction, level of difficulty, engagement, relationship between the player and NPCs
- Has a big research area - making AI interesting and solving complex problems, which can be applied to real world problems with robots

- Potentially talk about Halo 2 AI, which made the game very engaging and fun to play - as an example

IV. Curiosity

Curiosity is a driving force for human's exploration, which consists of exploration, investigation and learning behaviours (cite "Curiosity: From Psychology to Computation"). It makes people chase for knowledge and investigate anything new and potentially valuable (for any reason). Moreover, curiosity is beneficial for people on two levels: the individual and the social levels (cite "Kashdan" from "Curiosity: From Psychology to Computation"). The first one is represented as the "innate love of learning and of knowledge... without the lure of any profit" (cite Loewenstein). The social level, on the other hand, is presented as "an ingredient for enhancing personal relationships" (cite "Curiosity: From Psychology to Computation").

- Why do curiosity?
- Examples of curiosity-driven behaviours
- How will it make AI look smarter?
- Challenges that occur trying to implement such behaviour
- Explain why curiosity is one of the main drivers that lead human to explore/do something

V. Turing's Test

- Explain Turing's test
- Why use this testing method?
- Explain how I'm gonna test my implementation
- Briefly go over what question I'm going to use to get the participants' data

VI. Methodology

- How the hypotheses will be tested?
- Include potential questions
- Maybe include an example of similar test?

VII. Hypotheses

The aim of this paper is to implement a simple exploration behaviour and test it to see whether it makes the AI smarter. This concern is the first hypotheses of the paper. Previously mentioned testing, which requires participants to distinguish player's behaviour and AI's behaviour presents us with another hypotheses. This time we are looking if the AI's behaviour is human-like. Hypotheses 3 depends on the participants' answers - if they cannot distinguish between player and AI, it proves that the AI is human-like, which delivers positive outcome (for this paper).

- The AI will feel smarter
- The participants won't notice the difference
- The participants won't distinguish human's behaviour and AI (which is good)

VIII. Conclusion

The conclusion goes here.

Appendix A
First appendix

Appendices are optional. Delete or comment out this part if you do not need them.