Development and Evaluation of Ingame Latency Compensation Technique based on Artificial Neural Networks

Thema:
> Development and Evaluation of Ingame Latency Compensation Technique based on Artificial Neural Networks

Art:
> BA

BetreuerIn:
> David Halbhuber

BearbeiterIn:
> Julian Hoepfinger

ErstgutachterIn:
> Niels Henze

ZweitgutachterIn:
> Valentin Schwind

Status:
> abgeschlossen

Stichworte:
> Counter Strike, Latency, ANN

angelegt:
> 2021-04-27

Antrittsvortrag:
> 2021-07-12

Hintergrund

"Latency from a general point of view is a time delay between the cause and the effect of some physical change in the system being observed" [1]. Latency in video games impairs the performance of the player and game experience. The performance in fast-paced games like Counter-Strike: Global Offensive (CS:GO), which require precision and have tight deadlines, is dependend on the latency [2, 3]. There are three main latency compensation techniques to improve game experience and performance [4].

- Delayed input techniques try to add delay to local actions to allow simultaneous execution by all clients [4, 5].
- Time-offsetting techniques enable a rollback to the previous state of the game [4, 5].
- Predictive techniques estimate the occurring events in the game from the locally available state [4, 5].

The goal of this work is to build a predictive technique for CS:GO using artificial neural networks (ANN). ANNs have been successfully used in computer vision tasks, such as pattern recognition in images [8], to predict avatar movement in VR [7] or reduce perceived input latency on touch devices [4]. However, one problem of ANNs is their long runtime due to internal complexity [9]. If used for

latency compensation in video games, the ANNs inference needs to be fast and lightweight. If inference takes too long an ANN based latency compensation technique ultimately leads to an increase in overall latency.

This work aims to build and evaluate a predictive system to decrease perceived latency for CS:GO.

Zielsetzung der Arbeit

Firstly a suitable way to collect data from CS:GO needs to be implemented. There a two possible ways to collect data: (1) Directly log user input and game screen while live-playing and (2) use openly availabe CS:GO replays. Both approaches need to be evaluated and analyzed regarding their feasablity for this works aim.

After collecting a suitable data set from either one of the above options the ANN needs to be developed. The ANNs prediciton is based on the previously gathered data and ultimately should be able to infere the users next inputs.

After training the ANN, it is evaluated in various scenarios. The goal is to determine if the developed predictive system is suitable for latency compensation in CS:GO.

Konkrete Aufgaben

- Literature research
- Create a suitable dataframe for ANN training
- Train the latency compensation model
- Evaluate the developed model
- Write the thesis

Erwartete Vorkenntnisse

- Tensorflow, Pytorch or Keras
- Programming in C++/Python and Unity
- Data analysis

Weiterführende Quellen

[1] Latency. (2021). Wikipedia. https://en.wikipedia.org/wiki/Latency_(engineering), Retrieved: 21.04.2021.

[2] Claypool, M., & Claypool, K. (2006). Latency and player actions in online games. Communications of the ACM, 49(11), 40-45.

[3] Claypool, M., & Claypool, K. (2010, February). Latency can kill: precision and deadline in online games. In Proceedings of the first annual ACM SIGMM conference on Multimedia systems (pp. 215-222).

[4] Niels Henze, Markus Funk, and Alireza Sahami Shirazi. 2016. Software-reduced touchscreen

latency. In Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services. 434–441.

[5] Savery, C., & Graham, T. N. (2013). Timelines: simplifying the programming of lag compensation for the next generation of networked games. Multimedia Systems, 19(3), 271-287.

[6] Sabet, S. S., Schmidt, S., Zadtootaghaj, S., Naderi, B., Griwodz, C., & Möller, S. (2020, May). A latency compensation technique based on game characteristics to mitigate the influence of delay on cloud gaming quality of experience. In Proceedings of the 11th ACM Multimedia Systems Conference (pp. 15-25).

[7] Valentin Schwind, David Halbhuber, Jakob Fehle, Jonathan Sasse, Andreas Pfaffelhuber, Christoph Tögel, Julian Dietz, and Niels Henze. 2020. The Effects of Full-Body Avatar Movement Predictions in Virtual Reality using Neural Networks. In 26th ACM Symposium on Virtual Reality Software and Technology. 1–11.

[8] Albawi, S., Mohammed, T. A., & Al-Zawi, S. (2017, August). Understanding of a convolutional neural network. In 2017 International Conference on Engineering and Technology (ICET) (pp. 1-6). Ieee.

[9] Cai, E., Juan, D. C., Stamoulis, D., & Marculescu, D. (2019). Learning-based Power and Runtime Modeling for Convolutional Neural Networks.