



The Research and Analysis of Game Volume Increments

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Abstract. With the continuous development of hardware, the picture quality of games also has a qualitative leap, but at the same time, the improvement of the picture quality also makes the game bigger and bigger, the hardware requirements are also higher and higher. However, at this stage, there is no good solution to reduce a portion of the storage space of the game. This article gives an overview of why mainstream games have become bigger, and analyses how games have become more refined through texture mapping, optimizing for different games to relieve some of the storage pressure. It discusses the current situation of developers using technologies such as DLSS to help with partial optimization. In the end, the article summarizes and looks forward to the whole paper, hoping that future game developers will not only focus on the so-called picture quality to develop games, but should focus on some optimization, so that the game has more audience and reduce the storage space required for the game.

Keywords: Game; volume increments; deep learning super sampling; AI training

1 INTRODUCTION

With the rapid development of hardware technology, the picture quality of the game has also made a qualitative leap, but at the same time, the improvement of the picture quality has also made the game bigger and bigger, and the hardware requirements have become higher and higher. Developers started thinking about what caused games to get bigger and if there was a way to make them take up less storage space. However, at this stage, there is no good solution to reduce a portion of the game's storage space.

In the continuous development of graphics, video coding has been playing an indispensable role. At the same time, video coding is also very important for games. With the development of games in recent years, the volume of games is getting bigger and bigger, from the video coding people found the similar way that can deal games. The reason why the game is getting bigger and bigger is because the texture maps are becoming more and more detailed, but this will make the player need to update the computer's configuration all the time. It can be observed that the player's need for hard disk capacity is also becoming more and more. Large, from the earliest 128g to the current 1 t may not be enough. At this time, game developers began to think about whether there was a technology that could help solve these problems. At this time, NVIDIA

gave a solution, which is to allow games to use DLSS (The full name of DLSS is Deep Learning Super Sampling [1], which is an image scaling technology developed by Nvidia that can be used in video games in real time. Display on higher resolution computer monitors) and also other hardware company publish the similar way too. The author believes that there is not much improvement in the so-called picture quality of the game at this stage. It is better to choose to optimize the game to reduce the required computer configuration requirements and reduce the storage space required by the game [2]. The audience of the game has become wider, and it is no longer only players with top computer configurations, so what the author mainly wants to study is why the game is getting bigger and bigger, and the configuration requirements are getting higher and higher. But at this stage, there is still too little research on how to do this series of things, and further research is still needed. There is really no good way at this stage, and the game is getting bigger and bigger, and the requirements for hardware are getting higher and higher.

2 GRAPHICS AND VIDEO CODING GIVE THE INSPIRE FOR THE GAMES

Video coding for graphics is an indispensable part of video coding in the treatment of the graphic on the data of played a key role, Video coding makes high-definition video distribution impossible, for example, of games to do now is more and more sophisticated, texture map for graphics memory and hard disk size is a challenge, then there is the DLSS such technology to help deal with the graphics [3]. It reduces the amount of data that needs to be transmitted and uses AI to help complete the picture, just like video coding (Figure 1).

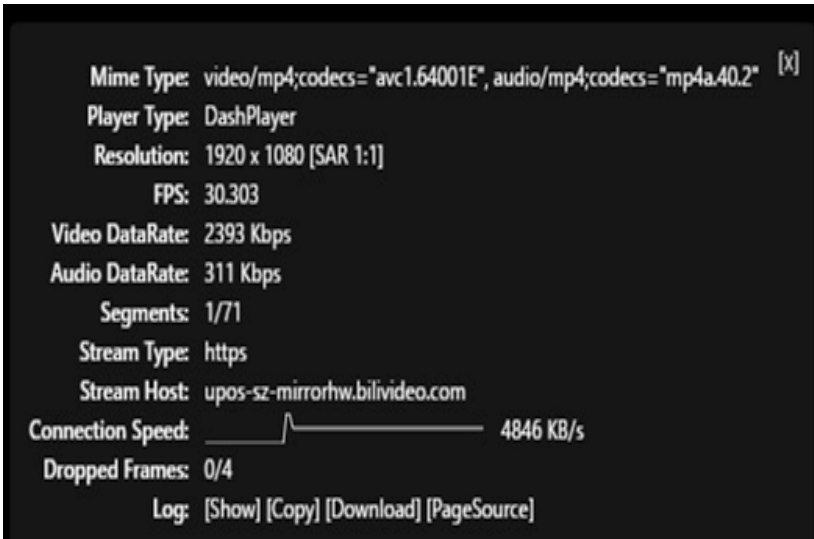


Fig. 1. Graphics and video coding give the inspire for the games

First video coding is to serve the spread of graphic data, so the first point, first it needs to be standardized, and standardization of the biggest advantage is that it makes the inter-operability of different products, the second is in the case of standardized development, every innovation of video coding has brought new applications and other possible. For example, the video encoding format of AV1 improves the storage space of 4K video, which used to require more than 10 gigabytes. 4K video no longer requires so much storage space [4]. The author thinks that it can hang on the texture material and game relationship, now due to hardware technology have been greatly improved, and not a lot of game production company will be pay attention to this aspect of the optimization, lead to the game of storage space occupied more and more big, but from the video coding technology, large game production companies can consider to make new game engine, Add new coding techniques similar to video to optimize textures and reduce the storage footprint of games (Figure 2). It is possible to do this by training the AI so that it can help display in-game texture details without having to download many textures. This reduces the amount of storage required for the game to some extent.

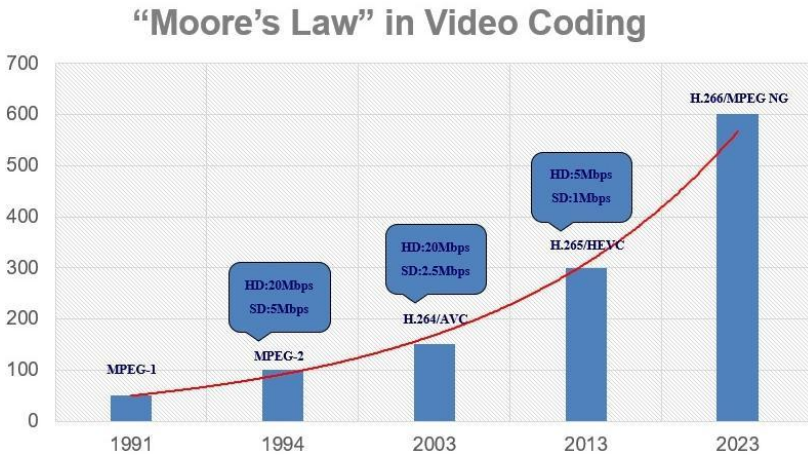


Fig. 2. Development and application of video coding

3 AI TRAINING FOR GAME OPTIMIZATION

In traditional optimization, if developers want more players to play, they must use the performance of computer hardware as much as possible. For example, Devil May Cry 4, this game is a typical optimization to the extreme in the production process, the developers optimized the attack screen of the action game to the extreme, and processed some details of the screen with low precision, so players do not need a good configuration to be able to play Devil May Cry. However, with DLSS technology, developers no longer need to optimize to such a degree. The advantage of this is that the development cycle can be greatly accelerated, and there is more time to test the game [5]. DLSS class technology in today's game widely use the purpose is in order to allow more players to play the game, does not need to be a top player's hardware, under the optimization of game developers, even without a good hardware configuration can also smooth running

game, in the process of DLSS technology has played a key role, In the case of DLSS, the essence of this technology is to train the AI to achieve almost the same realistic effect and smoother game experience with reduced picture quality. In fact, the picture quality is reduced on the basis of DLSS technology, but because of its particularity, the picture quality is ensured by training AI to supplement the picture. Most of today's big games support DLSS, which allows them to be played by a wider audience with less demanding configuration requirements.

3.1 DLSS and The Games

DLSS can now be said to be a good choice for game developers. NVIDIA is also constantly updating DLSS on generations of graphics cards, and AI can provide more and more optimizations. To a certain extent, if a game AI can be used to supplement all textures, light and shadow, and details, so the hard drive capacity required for this game can indeed be reduced a lot. After all, all the optimizations previously done by developers can be done by training AI, which is fine for single-player games. Here players can use Cyberpunk 2077 as an example. DLSS can greatly improve the player's game experience. For example, the player's hardware is a 30-series graphics card. It turned out that if the player wants to experience 2k without DLSS turned on in terms of image quality, the number of frames may only be about 70 frames, but after DLSS is turned on, AI will automatically optimize, and the number of frames can reach about 120 frames [6]. What the AI does behind this is to reduce the original image quality and make the game It runs more smoothly, but at the same time, AI is automatically optimizing the game screen. What players experience is that the game becomes smoother under the 2k screen, and there is almost no change in the screen. This is the power of DLSS technology. As the author wrote earlier, DLSS helps developers save a lot of time in optimization, so developers can greatly reduce the development cycle to do other parts (Figure 3). But for players, it is still necessary to update their equipment according to the new game and this technology only supports gamers with NVIDIA graphics cards.



Fig. 3. DLSS and the games

3.2 Why DLSS wasn't The True Way for The Games

In the final analysis, using DLSS is a kind of compromise for developers to NVIDIA. This kind of compromise is not a good thing for game development. Since NVIDIA has invested a lot in DLSS technology, if game developers agree the support of DLSS technology, it is necessary to continuously match the NVIDIA graphics card during the development process, but this is unfair to players who use other brands of graphics cards. Other players cannot get the same gaming experience as players with NVIDIA graphics cards, it may even be a negative experience, which is not a good thing for the game's reputation. And the texture and material map of the game are still not less than a little bit, so it is impossible for the game to reduce the hard disk capacity occupied [7]. It can be said that optimizing games by training AI is a good thing, but the monopoly of this technology by a hardware manufacturer is not a good thing for game development. The author hopes that in the future, there will be a technology that supports all games and devices of all hardware manufacturers, which may have the opportunity to reduce the space required for games.

4 THE REASON THE GAME GOT BIGGER

4.1 Pursuit of Image Quality

DLSS is certainly a good optimization option, but the capacity space required by the game is not reduced at all, so the author is thinking whether there can be a technology that can not only help players improve the game experience like DLSS, but also reduce some game requirements (Figure 3). capacity, but there is no technology that can help to do this, which is a pity at this time. Since the current games are improving the picture quality, I hope the game can be more and more detailed, but no better optimization plan has been made, resulting in the game only getting bigger and bigger. But this goes back to the original question [8]. Game developers don't pay much attention to game optimization anymore, and leave all problems to the player group to deal with. After all, game developers may spend a lot of time on optimization and can't compare to players to upgrade their computer. For example, taking the Battlefield series as an example, the promotion of Battlefield 2042 and DICE can be said to be inconsistent, which is very unfriendly to players, and the optimization of 2042 can be said to be completely unqualified(Figure 4). It's like a semi-finished product, and the experience during the test is almost the same. Even if players have the best hardware equipment, they can't experience the game content very happily. In terms of picture quality, players think that there is almost nothing compared to Battlefield 5(Figure 5). Improvement, the stability of the game is not as good as that of Battlefield 5. These are all caused by the unqualified optimization. Compared with Battlefield 5, Battlefield 2042 has 10 g more. The content of these 10 g is probably still texture and material map. All of these have contributed to the bad reviews of Battlefield 2042.



Fig. 4. Pursuit of image quality(Battlefield 2042)



Fig. 5. Pursuit of image quality(Battlefield 5)

4.2 Unlimited Installation Packages

Another reason for the growing size of games is that there is no longer a platform to limit the size of the installation package [9-11]. It is best to use mobile games as an example. The author observed that most game installation packages on mobile phones a few years ago. It is only a few mb. In the beginning, some mobile application malls only allowed game developers to upload installation packages of about 10m. If this standard is not followed, games are not allowed to be put on the shelves. Therefore, mobile game developers are compressing their games at first, but later there are no restrictions. The installation package begins to grow larger. After in-depth understanding, it is also because the application store at that time will limit the size of the installation package of major developers, but with the development of mobile phones, the storage space of mobile phones is also getting larger and larger, and applications The store no longer restricts the size of the installation package, but like the games on the PC and console, the games in recent years have hardly seen any significant improvement in the screen, so the author believes that game developers should not only pursue the so-called screen experience [12].

4.3 The Audio Changes

Up to now, many developers have used 5.1 surround sound audio and mono audio, which greatly expands the capacity of the game. Of course, the other point is that the audio files in the game far exceed the previous games. The impact is actually greater. The main reason for this is players' pursuit of game sound effects, and developers also pay special attention to the quality of audio.

Finally, if game developers don't make some changes, the hard disk space occupied by games cannot be reduced. Blindly improving the so-called picture quality does not mean that it will bring better games. In fact, it is not difficult to find new games in recent years and game in the past few years do not have such enormous improve [13]. The picture quality of games from a few years ago has not been significantly improved, but the hard disk space occupied by them is constantly increasing due to the so-called picture quality of developers.

5 CONCLUSION

Essentially, games are getting bigger and bigger mainly because of more content, and textures and textures account for the largest proportion of them. Since players' computers have been upgraded all the time, the game experience players want is not limited to the past. With low resolution, more and more players are beginning to pursue the so-called extreme image quality, which leads to the need for more and more refined texture materials and maps. At this stage, there is no better solution. If the original traditional optimization solution is used, the game development cycle will be greatly extended. However, if users rely on DLSS technology, the hardware requirements for players will become higher. These two Neither is the optimal solution. The author hopes that in future research, a technology can combine these two optimization methods and use AI to achieve optimization, but this also requires the replacement of the existing game development engine or optimization, which is also an engineering amount and it's a big project, and if the new engine can't be universal, it can't realize the smaller capacity required for the game, and the hardware requirements can be reduced. These are the problems that need to be solved.

In future research, the author believes that the game may still need new optimizations to change. The main problem that needs to be solved in future research is that all game developers need to agree to use the new engine or technology, and the difficulty of use cannot increase too much, otherwise developers still need to spend a lot of time to adapt and learn how to use it or it cannot be a good thing for the game development cycle.

REFERENCE

1. Hirano A, Nakayama K. Parallel Simulation of FIR Adaptive Filters on nVIDIA GeForce Graphics Processing Unit. 2021, Micro. Rep. **12**
2. Scharon Harding, What Is Nvidia DLSS? 2021, *A Bas. Def.*, **23**

3. Andrew Burnes, NVIDIA DLSS: 200 Games & Apps Now Available, 2022 *J. Exp. Soc. Psy.* **07**
4. J Chen, Y Chen, M Karczewicz, X Li, H Liu, L Zhang, Coding tools investigation for next generation video coding, 2015 *Int. Conf. Net. Inf. Sys. Com.* **223**.
5. Y.-J. Chang, C.-C. Chen, J. Chen, J. Dong, et al, Compression efficiency methods beyond VVC, 2021 *Smpte. Tec. Conf.*, **018**.
6. Globe Newswire, NVIDIA Introduces DLSS 3 With Breakthrough AI-Powered Frame Generation for up to 4x Performance, 2022 *IEEE Trans. Circ. Sys. Video Tec.* **20**
7. Matt Wuebbing, With DLSS 2.0, AI Continues to Revolutionize Gaming, 2020 *Int. Conf. Net. Inf. Sys. Com.* **637**.
8. Geske D, Hess R, Fischer S, et al. Fast and predictable video compression in software design and implementation of an H.261 codec, 2008, *Broad. Euro. Net. Multi. Ser. Int. Soc. Opt. Pho.*, 498-508.
9. Alla Levin, Tips for Optimizing an Online Gaming Experience, October 23, 2020
10. Yuan Qing, Research and Implementation of H.265-based Video Rapid Codec, 2022 *Int. Conf. Net. Inf. Sys. Com.* **02**
11. Bajovic, Mirjana. Violent Video Gaming and Moral Reasoning in Adolescents: Is There an Association? 2013 *Edu. Med. Int.* **50**, 177–191.
12. Christopher P. Barlett, Craig A. Anderson and Edward L. Swing. Video Game Effects Confirmed, Suspected, and Speculative. 2008 *Sim. Gam.*, **40**. 377–403.
13. Engelhardt, Christopher R., et al. This Is Your Brain on Violent Video Games: Neural Desensitization to Violence Predicts Increased Aggression Following Violent Video Game Exposure. **2011**, *J. Exp. Soc. Psy.*, **47**, 1033-1036.

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