Cancer and Virtual Reality

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1 Introduction

As technology develops, computer science research was developed prominently. Therefore, the medicine research that is combined with computer technology research such as artificial intelligence and virtual reality has been developed. These days, when the medical technologies are developed, it is difficult to cure cancer. However, more people can suffer from cancer. According to the National Cancer Research Center, it is said that one in two people suffer from cancer as for the Japanese in life. Many researchers are studying how to cure cancer. This paper focuses on the research which combines such cancer research and the current virtual reality technology.

This paper surveys whether it is possible that the technology of the previous research which finds new cancer characteristics by using Virtual Reality is used to treat cancer patients.

Previous research suggests that by using Virtual Reality new cancer characteristics can be found. This paper suggests that using Virtual Reality also makes it possible to survey new treatments of cancer and find the best treatment for each cancer patient.

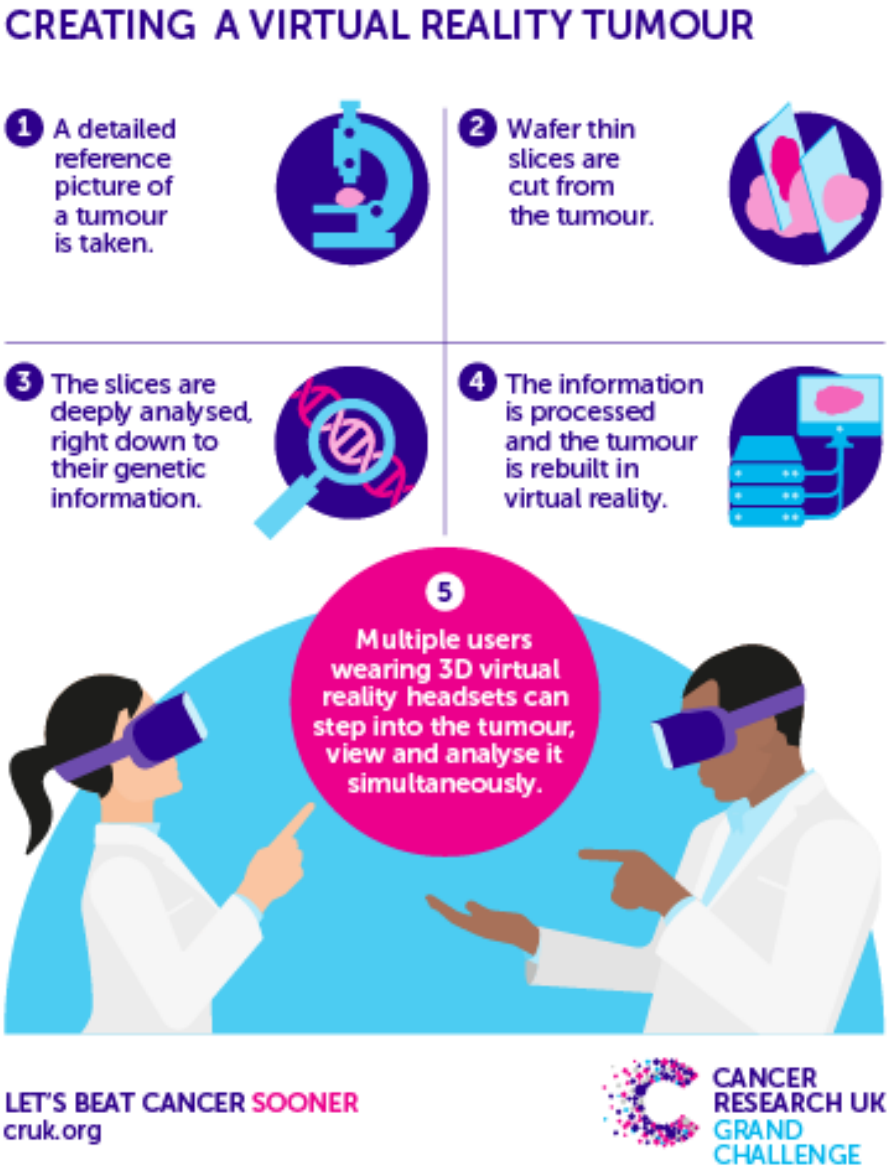
It is hypothesized that it might be possible, by using the technology, to find the best treatments for each cancer patient and simulate the best treatments in Virtual Reality.

2 Fundamental

“They aim to gather thousands of bits of information about every single cell in a tumour – from cancer cells to immune cells – to find out what cells are next to each other, how they interact with and influence each other, and how they all work together to help tumours survive and grow.

They will then take all the information they collect about the cells in a tumour and use it to construct a 3D version that can be studied using virtual reality.

Using virtual reality will allow scientists to immerse themselves in a tumour, meaning they can study patterns and other characteristics within it, in entirely new ways that aren’t possible in 2D. It will also allow multiple doctors and scientists to look at a tumour at the same time, meaning people at opposite ends of the country, and with different areas of expertise, can work together to help diagnose and treat patients better.” （Retrieved 2017 from Professor Greg Hannon’s IMAXT team https://www.cancerresearchuk.org/funding-for-researchers/how-we-deliver-research/grand-challenge-award/funded-teams-hannon）
It is found that cancer cells don’t exist uniformly but they exist based on the tumor by using Virtual Reality.



3 Method

I met with Dr Dario Bressan (Head, IMAXT Laboratory) who studies the cancer research that is combined with

Virtual Reality and asked some research questions on 1 August 2019.

My research questions

①My question

I think by using this VR technology in hospitals, patients can have treatments to match their specific tumours.

①Answer to my question

That's kind of the idea. Right now there are 11 types of breast cancer. There will be more than that. It's more so it's possible that each patient is different or it's possible that there are more classes than we currently know but not an infinite amount of types of tumor cells. But just a subset of them we can find what is the best treatment for patients. You would normally get this but are given how these environment in your cells look like. It's the hope that we can use these to decide the best treatment for each patient. If we learn more about how the tumor develops, we can actually come up with better treatments. Then using virtual reality can be useful because you can use them as a doctor to explain to the patient why you are giving them that therapy. It's kind of difficult sometimes to explain using big words. You can actually show them and say, "this what your tumour looks like. This is why we want to treat you this way."

②-1 My question

Are you thinking about making individual 3D models of tumours?

②-2 Answer to my question

It is going to take a while before we can do that because taking this kind of image takes a long time right now. It takes a few months. We are trying to decrease the time that it takes to do these measurements so that it will take two weeks instead of one month and then it would be possible that a patient could get surgery. The tumour that is removed during the surgery would be of an early stage, and then that model could actually be used to help decide the best therapy for the patient. So it's definitely on the roadmap. But right now cost of this and the equipment that is needed for each would be too much to do it on many patients. Like with that one sample we took basically one year to make it, it will get faster. So we don't necessarily need all of the data for all of the patients. We hope we're going to realize what is the most important thing to actually read and then we can save time.

③-1My question

By using this technology can you find the trend that invasive cancer is growing into surrounding areas?

③-2Answer to my question

This technology is a snapshot so you take it at a specific time and you look at an image of how the tumour is there. So if you find invasive cancer, you don't know whether it will become invasive or not. What you can do is, you can try to see what the differences in each subgroup of the tumor looks like. That suggests that it might be about to become invasive because what big problem that there is in cancer biology is that some tumours can be contained forever with. Breast cancer sometimes when you get therapy it goes into regression. You don't have it anymore, then 20 years later it comes back and this is a problem called dormancy. So there are tumor cells that sleep. We hope if you can analyze the surroundings of the cells, and maybe the cells that are about to wake up have a different environment than the ones that are still sleeping. So, hopefully you can find out these early warning signs that the cancer is about to become this. But unfortunately you cannot see the process as it happens because this doesn't give us time, if just give us space, but hopefully you can use space together.

4 Results

By using Virtual Reality, cancer patients can have treatments that match each of them. If it is known more how a tumour develops, it is thought that better treatments will be found. Using virtual reality is useful to explain treatment option to cancer patients.

The problems in creating 3D models of individual tumours in the hospitals are the time it takes and the costs needed to create t. However, if these problems are solved, virtual reality will be used to treat cancer. Also it saves the time when we find what characteristics of cancer is important to treat cancer.

It is possible to look at a developed tumor. However it is impossible to look at the growth of the tumour. It is expected that indication of recurrence is found by finding the difference between the cancer cells that are dormant and normal cells.

5 Discussion

A 3D model of a tumour is useful to decide the treatments that match each cancer patient. It is also useful when gaining a better opinion of cancer treatments and to develop new treatments. Using virtual reality in order to explain treatments to cancer patients may reduce patient's anxiety about treatments.

It is possible to look at the aspect of a tumour when a 3D model of a tumour is created. It is assumed that if the cancer characteristics and the important things to treat cancer patients are found as the previous research makes progress, cancer treatments will be better and a 3D model of a tumour will be used to treat cancer patients.

There is a difference between the tumor that is in patients and the 3D model of tumours because the 3D model of a tumour doesn't grow. Therefore there is a possibility that patients are not treated in the best way. Is it possible to create a 3D tumour which is growing by studying the tendencies of a growing tumor in order to reduce the difference ?

The needed time, costs and facilities to create 3D models of tumours are problems. It is thought that the problem of the development time can be solved by finding new cancer features and developments of virtual reality. However, it is difficult to solve the problems of costs and facilities. Special microscopic analysis of genes are needed. If a simple 3D model is created by considering cancer features and using conventional technology such as blood test and image inspection method, the problems will be solved.

It leads to tumor dormancy therapy and new treatments that the difference between normal cells and dormant cancer cells are found by using 3D model of tumor.If the difference between dormant cancer cells and normal cells or indication of recurrent cancer is found, what treatments will their information lead to?

New findings which are expected by using a 3D model of a tumour in virtual reality are found from the researcher's viewpoints. However, it is assumed that it is efficient to discover the growth of a tumour and distribution features of cancer cells in tumor from the statistical data of the 3D model of a tumour. Is there a possibility to create 3D models of standardized tumours by statistical data and look at it in Virtual Reality?

The previous research needs a slice of a tumour to create a 3D model. However, it is assumed that it is impossible to get a slice of tumor from cancer patients who do not have surgery.

6 Conclusion

If 3D models begin to be used in the hospitals for each cancer patients, treatments of cancer will be less burden for them. It remains questionable that the time, costs and facilities needed to create 3D models. It is difficult to create 3D models of individual tumours in the hospitals. It also remains questionable how to create a 3D model of an individual tumour which is in each cancer patients. In order to solve these problems, some future researches are estimated. In order to reduce the time and costs needed to create 3D models, is it possible to create a simple 3D model of tumour by exam used. It was concluded that there are merits to using 3D models for cancer treatments, but now it is difficult to use it. However, it is used to study cancer characteristics.

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