

Virtual Reality for the visualization of high-dimensional relationships in bioinformatics

Subtitle

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Introduction

1.1 Background

With the increase of biological data, new ways of analysing the produced data have been necessary in order to discover interesting patterns and make the most out of it. No matter how content-rich or expensively obtained the data is if we don't obtain anything valuable.

Humans have a great ability to discover patterns, however we are biologically optimized to see the world and the patterns in 3 dimensions. Virtual Reality (VR) is one of the best ways for better discovery in spatial dimensions. It has been demonstrated that VR help scientists work more effectively in fields like medicine [3][4] and biology[5], to mention some examples.

1.1.1 Context

When the amount of data is considerably big, sometimes it can be difficult to explore it, especially when we are using a 2-dimensional space like a computer screen. One example is the MIxT web application (Matched Interaction Across Tissues)[2][1]. MIxT provides a tool to identify genes and pathways in the primary breast tumor that are tightly linked to genes and pathways in the patient blood cells[1]. One of the its features is a network view where genes are represented with nodes and the edges represent statistically significant correlation in expression between the two end-points. However exploring this

network and understanding the data and its relationships is hard because there is too much information.

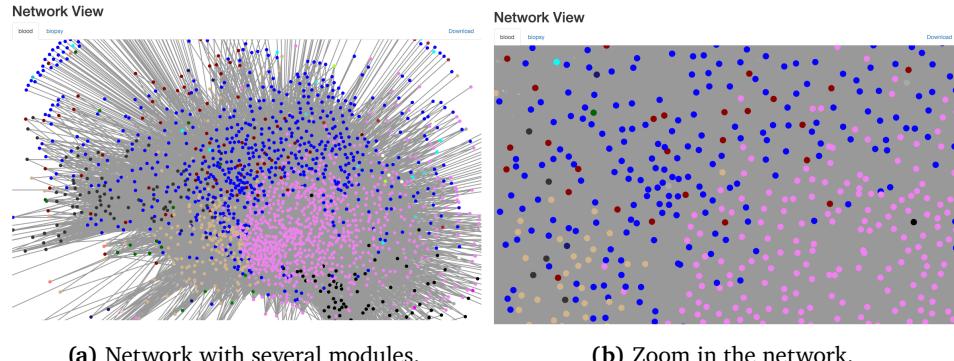


Figure 1.1: Network view of the MIxT application where nodes represent genes and the modules are represented by colors. Relationships are represented by grey lines that connect a gene with another one.

Figure 1.1 shows an example of the network visualization from MIxT. As we can see in Figure 1.1a, there are many nodes and relationships among them and when we zoom in in the network, it becomes too difficult to understand the data and the relationships as shown in Figure 1.1b.

1.1.2 Software and frameworks for VR development

Unity3D¹ and Unreal Engine² are 2 of the most used tools for development of virtual reality applications. They offer integrations for Oculus Quest and other VR devices in the market. In addition Oculus quest offers a development mode which can be activated once the glasses are connected to the PC. In this way the VR application can be tested directly on the VR device.

We can also find some web frameworks to build VR applications for the web. One of the most popular are A-frame³ and React360⁴.

1. <https://unity.com>
2. <https://www.unrealengine.com>
3. <https://aframe.io/>
4. <https://facebook.github.io/react-360/>

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