Quantum Computing Changing the Life We Know

Luca Bernecker

July 10, 2020

Classical computers that we currently work with have been around for a long time. One may notice that the improvements of classical processors become more and more challenging. A new approach to increase the computational power would allow our technology development to keep growing.

One can imagine that a classical computer uses many small machines, which can only perform one job at a time, but in quantum computing it is possible for all those machines to do two jobs simultaneously. The current problem with quantum computing "QC" is that it is very limited in its applications and quantum computers are very noisy and do not always give useful results. QC is mainly used within physics. In this work we try to apply quantum computations to an actual problem in computer science and try to expand the horizon of quantum computations.

An important computer science problem is that of reconstructing the 3D structure of an object from a set of 2D pictures. In this thesis we only use two cameras, which have different angles with a certain distance between each other. On each camera, a specific characteristic of an object can be identified, for example, a roof top as seen in Fig.(1). Those specific characteristics can be identified on each camera respectively. Using many points one compare the pictures and their features and recreate a 3D space out of the two pictures. The problem is, that the points of the two cameras may not meet at the exact same spot in an external 3D space. If the cameras move and angles change, the points of the different cameras may drift away from each other. That is why it has to be optimized, so that the two different cameras' project points are as close to each other as possible. The quantum computations intend to update the steps for the optimization, leading to that the points of the different cameras are at the same place in space.

Figure 1: Roof top by Linda Erwe

Two different quantum algorithms are introduced to solve the problem. One of the algorithms is used on a linear regression problem with four points and giving good results. After this was achieved, the algorithms were introduced to the computer science problem with the two cameras. In the thesis it was not possible to implement the quantum algorithms on this problem, but it can be believed that QC may successfully work for the computer science problem as well.