

It is unworthy of excellent men to lose hours like slaves in the labour of calculation which would safely be relegated to anyone else if machines were used.

(Gottfried Wilhelm Leibniz - see [“Handbook of Practical Logic and Automated Reasoning”](#))

We are taking for granted that computers facilitate our daily lives, in particular take care of all calculations. One of the first steps towards a modern computer was done more than 300 years ago by Leibniz, who [constructed a functional calculator](#). Leibniz’s mechanical design was very successful and re-used for centuries in later calculators’ designs. However, the mass business adoption of calculators based on his ideas happened only 200 years after Leibniz’s death, in the age of industrial revolution.



Figure 1: From the left, the Leibniz calculator, the Prometheus supercomputer located in Kraków (71st largest computer in the world), the TPU chip designed by Google to speed-up artificial intelligence. Prometheus and TPU chips will be used in this project.

Modern computers are not only calculators, but can also solve a variety of other tasks such as giving driving directions, solving a Rubik Cube in less steps than a human, or resolving the following logical puzzle:

Someone who lives in Dreadbury Mansion killed Aunt Agatha. Agatha, the butler, and Charles live in Dreadbury Mansion, and are the only people who live therein. A killer always hates his victim, and is never richer than his victim. Charles hates no one that Aunt Agatha hates. Agatha hates everyone except the butler. The butler hates everyone not richer than Aunt Agatha. The butler hates everyone Aunt Agatha hates. No one hates everyone. Agatha is not the butler. Who killed Aunt Agatha?

(problem PUZ001+1.p in the TPTP dataset)



Figure 2: Games in which artificial intelligence achieved excellent results thanks to the development of algorithms and computer hardware. From the left Seaquest (Atari 2600 game), Go and Dota 2.

In this project we are interested in using a modern computer to solve mathematical problems. Mathematical problems can be considered as very demanding logical puzzles. One can rightly argue that mathematics is more complicated than games in Figure 2, but this project is meant to test the boundaries of what can be achieved in automation of mathematics using currently available technical means. Progress in solving core mathematical problems will impact artificial intelligence performance in other places, because in the language of mathematics we can phrase a lot of practical tasks, for example movement of an autonomous vehicle.