Thesis Summary

I performed research to investigate new treatment options for cancer patients. To survive and reproduce, tumor cells require oxygen and nutrients which are delivered through blood vessels. In order to access these resources, a tumor can co-opt existing vasculature or grow new vessels in a process referred to as angiogenesis. Tumor growth can be slowed by inhibiting this process, essentially starving the tumor. This can be achieved with targeted drugs, which are already used in patients. However, in many cases, they are only effective for a short time before drug resistance occurs. Additionally, the high drug doses used are known to cause side effects.

We believe that these limitations of current cancer therapy can be overcome by combining multiple drugs. Finding the best combination therapy using different drugs at different doses is currently done by trial and error. This is impossible considering the number of possible combinations. To tackle this problem, we applied different engineering-based technique involving a learning algorithm, to rapidly identify the low-dose drug combinations that most effectively inhibit cell reproduction. We then validated this approach in preclinical tumor models. We conclude that our optimization method can be used to identify drug combinations for use in the clinic. An advantage of our approach is the use of low-dose drug combinations, which may reduce the probability of developing side effects and reduce the occurrence of drug resistance. These findings hold great promise for improving treatment options for patients with cancer.