Detecting Cells in Bone Marrow with Machine Learning

POPULAR SCIENCE SUMMARY **Robin Bram & Mattias Nässström**

The evolution of computer science has risen explosively in the last decade and in what field can this have the most impact on life quality if not in medicine. We have in this master thesis applied the most modern version of machine learning to find nucleated cells in images of samples taken from the bone marrow, which can help save lives through finding diseases such as blood cancer.

Being able to detect nucleated cells in human blood is a very important part of health care. Historically, this has been done through manual microscopy but today there exists several automated methods able to find them in ordinary blood samples. Sometimes it is not enough to only examine ordinary blood but a sample from the bone marrow, where the cells are created, is needed as well. An automatic detection of nucleated cells in bone marrow samples does not exist today. This project's aim was to find a machine learning algorithm that was able to do this with good performance. Machine learning has become more and more popular during the past years to solve a range of different problems. The main idea of machine learning is to teach a computer to make decisions by giving it information. This can be done in several different ways through different models. We found that the best performing model called YOLO (You Only Look Once) was able to find 97 % of the cells while staying very correct in its predictions. Several exciting new techniques helped our model to find more cells. One was active learning, where the model tells which images it can learn the most from and the cells in those images are then marked by humans. The model then gets these images back with the correct cells marked and can better understand what a nucleated cell looks like. Another technique that improved the performance was knowledge distillation where a large model learns from the images with the cells marked and then passes on its knowledge to a smaller model much like the relation between a teacher and a student in school.