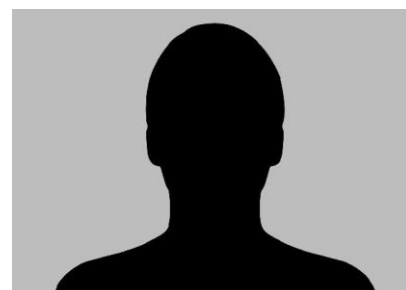


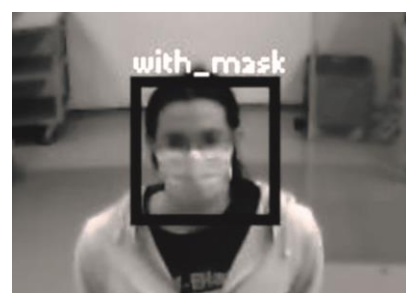
## ICU – The Recognizer 9000: Facemask Recognition on STM32

Due to the outbreak of the Corona pandemic in 2020, various measures to contain it have been enacted, including a mask requirement. BBC Bircher AG is interested in integrating a module into the new ToF sensor that detects whether a person in the field of vision is wearing a mask or not. This evaluation should take place locally on the embedded system and without a server connection. In this thesis different approaches from the field of neural networks are evaluated to realize such a module. Existing data sets containing faces with and without masks are considered for training and evaluation. Likewise, the possibility of generating datasets by artificially putting masks on the faces in existing datasets is discussed. For implementation, single pass approaches (SSD and YOLO), as well as two-step approaches, are investigated and tested. Furthermore, suitable hardware for the implementation as well as optimization possibilities for computing and storage resources are analysed. It turns out that single pass approaches without hardware optimization are not suitable and a two-stage approach is implemented and tested. Different methods for face localization (the first stage), including the use of the output of the ToF sensor, are presented. For classifying whether the localized person is wearing a mask or not (the second stage), a model based on a CNN is developed and optimized. Various difficulties found, as well as possible solutions to them, are discussed. The presented model is implemented on a STM32 platform and is able to perform several evaluations per second.

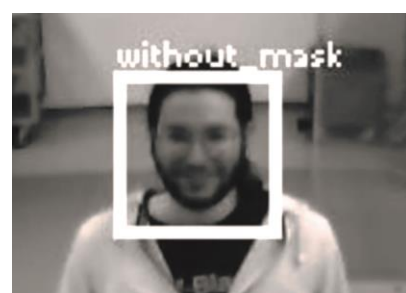


Diplomierende  
Mischa Kolb  
Thomas Witrahm

Dozierende  
Martin Ostertag  
Bruno Zimmermann



Example of successful recognition of a person with mask



Example of successful recognition of a person without a mask