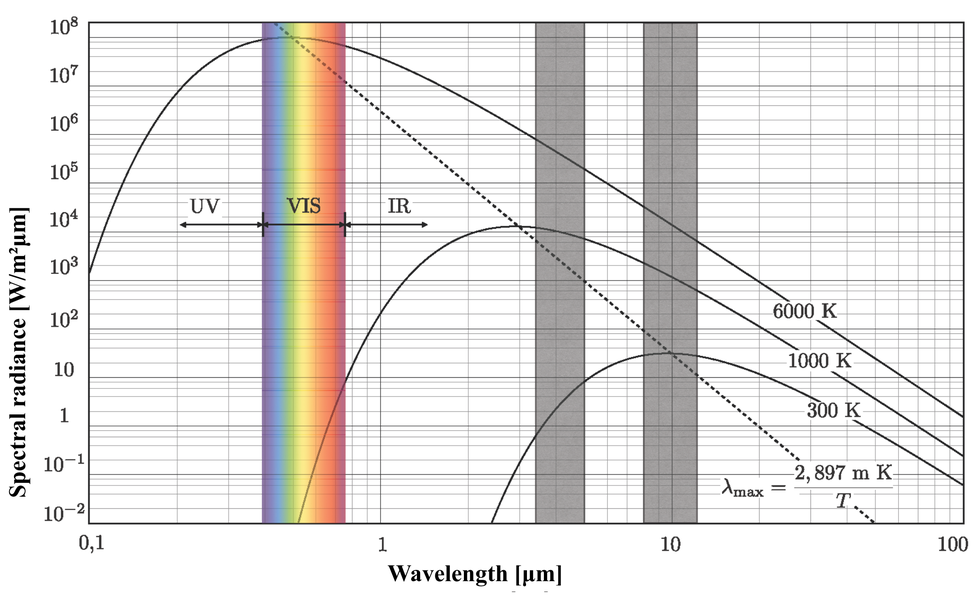
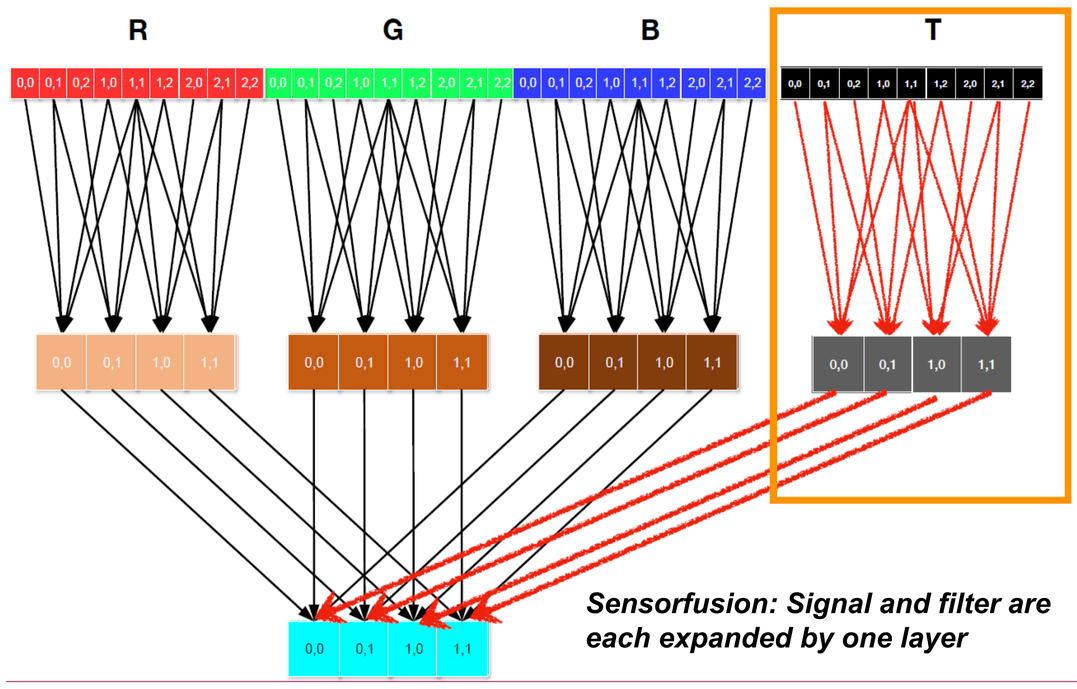
Artificial intelligence for improved automated disinfection processes

Willi Großmann, Helena Horn
Helmut-Schmidt-Universität / Universität der Bundeswehr Hamburg

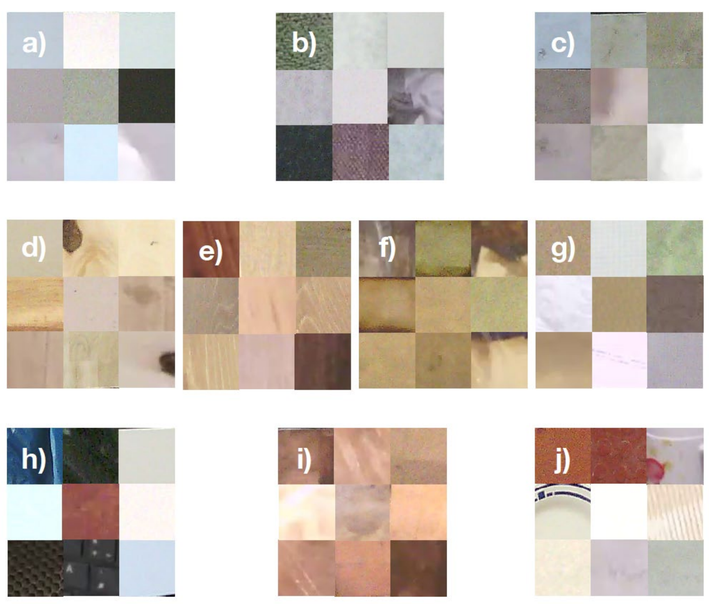
Boosting AI Material Detection Ability with Thermal Imaging



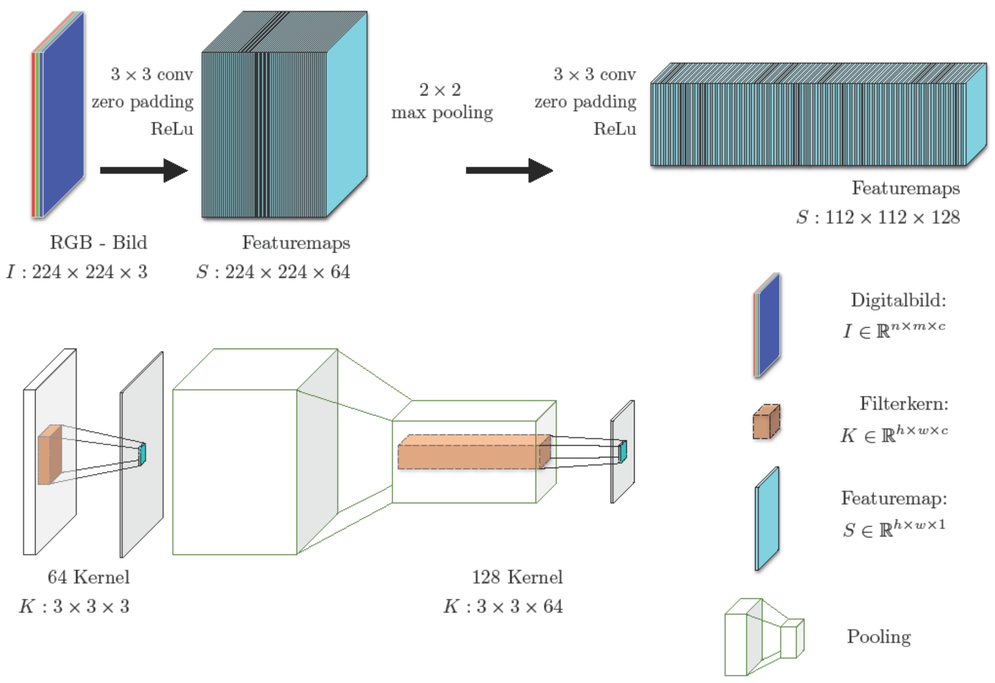
Analysis of a larger electromagnetic spectrum enables higher precision in material recognition

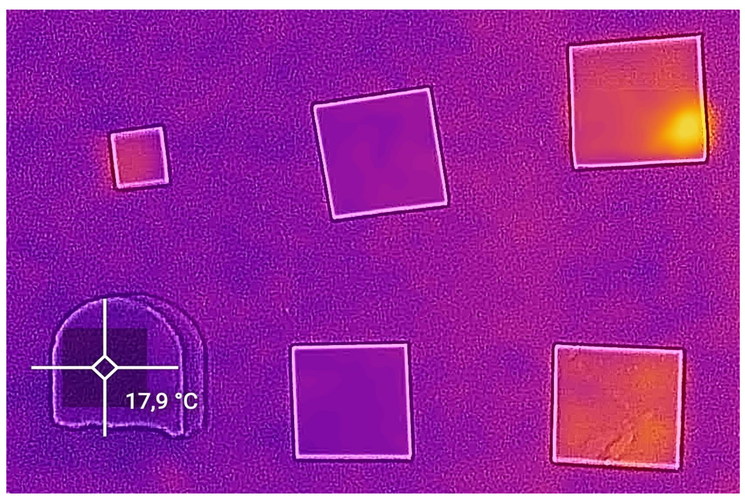


Due to the coronavirus pandemic, the development of automatized disinfection processes has recently become a field of special interest. The machine recognition of materials is highly important in these applications, because material properties influence the persistence of pathogens as well as the effectiveness of the disinfectant. Thus, an incorrect material classification could lead to an insufficient amount of disinfectant and therefore insufficient disinfection process. One contemporary approach for material recognition uses Convolutional Neural Networks (CNN) in order to base identification not only on the consideration of different kind of visual data but also on created and learned context between given information. Huge existing material databases enable the training of deep CNNs and allow investigations of material recognition possibilities on the basis of images. But still, it is difficult to transfer these latest recognition results into the wild—various lighting conditions, a changing image quality, or different and new material classes are challenging complications. The evaluation of a larger electromagnetic spectrum could be a solution, as the material specific information in the data increases. In this case, the identification could be almost 100 % precise, but this would require relatively expensive measurement equipment. As a solution, the usage of the IR range seems to be a good compromise because it requires rather inexpensive cameras for the detection of thermal radiation. In this study, the infrared (IR) emissivity as a material specific property is investigated regarding its suitability for increasing the material classification reliability. A deep learning model is combined with features from IR images. This approach increases the overall accuracy and helps to differentiate between materials that visually appear similar. The solution is verified using real data from the field of automatized disinfection processes. Finally, the presented algorithm outperforms other state-of-the-art sensor fusion approaches.



Visual (see figure above) and infrared images (see figure below) of various material samples were taken and entered into a database specifically designed for the purpose of this study





The combination of visual and infrared data enhances material recognition under bad visibility conditions