Multispectral imaging of microbially infected historic photographs

The aim of the project is to determine the research possibilities of the multispectral imaging technique in the context of reaching the content of the image and to determine the state of preservation and the possibility of preserving for the future historic photographs damaged as a result of microbiological infection.

Historic photographs are extraordinary archival materials. They carry knowledge about the past written in the universal language of images and the history of the development of data carriers hidden in old, forgotten photographic techniques and technologies. Photographs, like any other archival materials made of organic substances, are subject to slow and inevitable destruction, which may increase if the objects are exposed to improper storage or exposure conditions. One of the most destructive factors responsible for image loss and the decomposition of the photographic base is the occurrence of a microbiological infection. Mycelium growing on a photographic image covers the content of the object and makes it illegible, and over time its presence may result in the complete destruction of the object. The damage that has occurred is irreversible in the conservation process. That is why it is so important to find new possibilities to reach the hidden photographic image and to best identify the type and scope of occurrence of microorganisms. This is where multispectral imaging systems come in handy.

Multispectral imaging (MSI) is a tool increasingly used to generate files that make damaged works of art readable. This technique allows to capture features of a historic object that are invisible to the naked eye or when taking a standard photo or scan. This type of examination of works of art and documents is becoming more and more popular, mainly due to the low costs and the minimally invasive process for the monument. The MSI system consists of a monochromatic camera recording images in the full sensitivity range of the CMOS silicon matrix (300-1100 nm), using an illuminator capable of emitting a number of spectrally narrow bands of electromagnetic radiation. Images are recorded as reflectograms and fluorescence images for various combinations of the excitation and recorded light wavelengths. The resulting images are then assembled into the so-called data cubes and subjected to statistical analysis using specialized MSI analysis software. For the purposes of the project, a multispectral imaging kit will be created dedicated to the registration of microbiologically infected archival materials, as well as technological samples made using popular, historical photographic techniques, which will be microbiologically infected. The research work will try to answer the questions whether it is possible to reach a photographic image covered by a microbiological infection of a given type and read its content, and whether it is possible to determine the scope of the infection and predict its growth rate using precisely determined climatic conditions. The research work is also to check the possibilities of using multispectral imaging to identify the type of microorganism present in the facility and to identify the biological activity of the mycelium before and after the disinfection process.

The research conducted will be interdisciplinary in nature, and the results obtained will serve archivists and users of state archives (getting to the illegible content found in the photo), as well as art conservators and microbiologists responsible for the state of preservation and conservation of photographic collections.