An easy and cheap way to use smartphones as a microscope

Carsten C. Reichert, Alois M. Herkommer
Institut für Technische Optik, Universität Stuttgart

Motivation
The evidence of widespread diseases requires microscopic examination and evaluation by health care professionals. Smartphones are all around in developing countries and can serve as microscopes to improve global health care.

Investigated optical solutions
The simplest and most cost effective possibility is to use smartphone camera modules as an optical head like in reference [1]. We position them (reversed) in front of the smartphone camera and achieved a resolution of 360 line pairs per mm.

3D printed mechanics
We designed different objective holders for the smartphone camera modules. All of them are producible with a 3d-printer and suitable for many different smartphone manufacturers. All of the 3D printed mechanics allow mechanical focusing.

Recorded images
Artery, Cat lungs, Musculature, Mouse testis, Pancreas, Blood vessel, Cerebral cortex, Human scalp, Small intestine, Cat gland, Spinal cord, Human blood

Imaging of phase objects
We modified the optical head to create a smartphone phase contrast microscope. We also built a holographic setup. Both structures are inexpensive and allow imaging of phase objects with a smartphone.