

In [microsurgery](#), surgeons use [micro instruments](#) under high [magnifications](#) to handle delicate [tissues](#). These [procedures](#) require highly [skilled attentional](#) and [motor](#) control for [planning](#) and implementing [eye-hand coordination](#) strategies. Eye-hand coordination in surgery has mostly been studied in open, laparoscopic, and robot-assisted surgeries, as there is no available [tools](#) to perform automatic tool detection in microsurgery. Koskinen et al. introduced and investigated a method for simultaneous detection and processing of micro-instruments and gaze during microsurgery. They trained and evaluated a [convolutional neural network](#) for detecting 17 microsurgical tools with a dataset of 7500 frames from 20 videos of simulated and real surgical procedures. Model evaluations result in mean average precision at the 0.5 thresholds of 89.5-91.4% for validation and 69.7-73.2% for testing over partially unseen surgical settings, and the average inference time of 39.90 ± 1.2 frames/second. While prior research has mostly evaluated surgical tool detection on homogeneous datasets with a limited number of tools, they demonstrated the feasibility of transfer learning and conclude that detectors that generalize reliably to new settings require data from several different surgical procedures. In a case study, they applied the detector with a [microscope eye tracker](#) to investigate tool use and eye-hand coordination during an intracranial [vessel dissection task](#). The results show that tool [kinematics](#) differentiate microsurgical actions. The gaze-to-microscissors distances are also smaller during dissection than other actions when the surgeon has more space to maneuver. The presented detection pipeline provides the clinical and research communities with a valuable resource for automatic content extraction and objective skill assessment in various microsurgical environments ¹⁾.

¹⁾

Koskinen J, Torkamani-Azar M, Hussein A, Huotarinen A, Bednarik R. Automated tool detection with deep learning for monitoring kinematics and eye-hand coordination in microsurgery. *Comput Biol Med.* 2022 Feb;141:105121. doi: 10.1016/j.combiomed.2021.105121. Epub 2021 Dec 11. PMID: 34968859.

From:

<https://neurosurgerywiki.com/wiki/> - **Neurosurgery Wiki**

Permanent link:

https://neurosurgerywiki.com/wiki/doku.php?id=motor_control

Last update: **2025/04/29 20:26**

