

The **Laboratory for Surgical Planning and Robotic Cognition (SPARC)** offers a

Position as Research Assistant (m/f/d) with the perspective of a doctorate

for a research project with the tentative title

Intraoperative AI-based Assistance for Endometriosis Surgery

The Project:

Endometriosis is one of the most common gynecological conditions affecting 10-15% of women of reproductive age, leading to chronic pain and reduced fertility. In Bavaria alone, approximately 50,000 cases are reported annually. In a multidisciplinary team consisting of 7 different labs at 4 Universities in Bavaria, our innovative research focuses on integrating multimodal functional and structural non-invasive imaging methods with artificial intelligence to create a comprehensive 3D pelvic model and provide early detection of endometriosis as well as surgical support. The model is further enriched with intraoperative and postoperative data to improve diagnostic and surgical outcomes.

The focus of **this doctoral position** is the development and implementation of an AI-driven intraoperative assistance system. This system is designed to enhance the planning and execution of laparoscopic procedures for the diagnosis and surgical treatment of endometriosis. The system aims to assist surgeons by improving visualization, navigation, and decision-making during surgery.

Key Responsibilities:

- **AI-Driven Detection and Segmentation:**
 - Develop methods for semantic segmentation and detection of endometriosis lesions from endoscopic video streams.
 - Implement AI tools for intraoperative labeling and dynamic updates of the deformable patient-specific pelvic model.
 - Automate classification of anatomical structures and potential endometriosis lesions during surgery.
- **Preoperative Support and Planning:**
 - Design risk-aware operation planning features using an AI-enhanced 3D pelvic model.
 - Integrate modules that analyze historical patient data and anatomical structures to propose personalized surgical plans and steps.
 - Optimize instrument paths and estimate the number, size, and grade of endometriosis lesions to prepare the surgical team effectively.
- **Human-Machine Interface Design:**
 - Develop an intuitive human-machine interface to guide surgeons during the operation, including augmented reality overlays and real-time annotations.
 - Implement optional voice-controlled features for interactive feedback and real-time updates on lesion status during surgery.
- **Validation and Deployment:**
 - Develop and refine AI methods on retrospective datasets and validate their effectiveness independently on prospective data in a clinical study.
 - Collaborate with clinical teams to ensure the system aligns with surgical workflows and enhances operational efficiency.

Qualifications:

- Above-average university degree (Master's or Diploma) in computer science or engineering sciences, or relevant adjacent fields
- Relevant disciplines regarding the university degree: Computer Science, Electrical Engineering, Mechanical Engineering, Mechatronics
- Ability and willingness to work both independently and collaboratively with a diverse team in a goal and solution-oriented manner
- Good knowledge in the fields of Machine Learning, Software, Computer Vision
- Experience in development and implementation in Python or C/C++
- Very good English language skills, both written and spoken; German language skills are advantageous
- Positive attitude, strong social and communication skills, initiative, commitment, high sense of responsibility, and creativity.
- Having peer-reviewed publications or conference papers can be a strong advantage.

Additional Descriptions:

- Aim for doctorate (Dr.-Ing.) at FAU
- A fully funded position (100%, TVL-E13) in a young, dedicated, and innovative team that addresses significant medical and technical challenges using scientific methods
- A creative and inspiring work environment where you collaborate with renowned partners from research, medicine, and industry to develop, implement, and analyze innovative projects
- Interdisciplinary project work and a top-tier national and international network
- An excellent starting position for an academic career or a career in leading industrial companies
- Development and experience in teaching, taking on leadership roles in student projects
- Possibility for (part-time) remote work (home office)

The SPARC Lab:

The laboratory for Surgical Planning and Robotic Cognition (SPARC) at FAU Erlangen-Nürnberg investigates cognition guided robots for surgical assistance in minimally invasive procedures, intelligent and flexible surgical instruments, and intuitive interfaces between humans and robots in the operating room. The SPARC laboratory conducts interdisciplinary research in close collaboration with national and international partners. We aim to contribute to building a healthcare system that enables optimal and personalized treatment of patients through targeted interactions between surgical experts and the next generation of minimally invasive surgical robots and assistance systems.

You can find more information about the lab and our research on our website: www.sparc.tf.fau.de

FAU promotes equal opportunities. Female candidates are specifically encouraged to apply. The position is open to start on 1. April 2025. Please send your application (until 22.1.2025) including cover letter with interests and background (max. 1 page), plus full CV and transcripts, as one PDF document via e-mail to Prof. Dr. Franziska Mathis-Ullrich (franziska.mathis-ullrich@fau.de), chair of the Laboratory for Surgical Planning and Robotic Cognition at FAU Erlangen-Nürnberg.

Please note that the candidate evaluation involves one or more scientific-technical presentations and interview appointments to be held in person or via teleconferencing. Applications sent via e-mail will be confirmed within a week. Furthermore, please note that applications not complying with the above requirements may neither be confirmed nor considered.