German Research Center for Artificial Intelligence

CASCADE

Cognitive AutonomouS CAtheters operating in Dynamic Environments

Three-dimensional model of an aortic arch

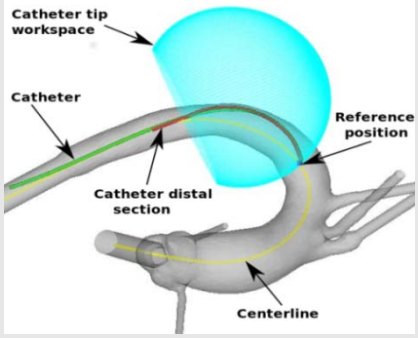
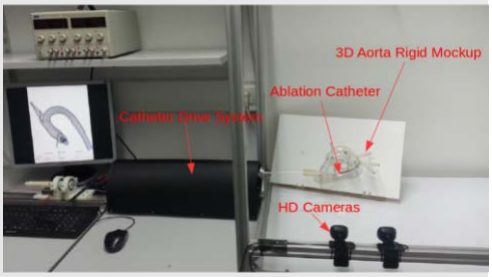


Illustration of a control approach for steering a catheter



Testbed for evaluation of control approaches in the three-dimensional model

Objective

The CASCADE project progresses the state of the art in catheter steering by developing a unified control framework for continuum robots that rigorously addresses the intrinsic interaction with complex and deformable environments. The proposed control framework will be applied and validated for the specific and challenging procedure of transcatheter aortic valve implantation (TAVI). The project will contribute to the development of surgical continuum robot as well as the cardio-vascular diagnostics or treatments. The effectiveness, reliability and repeatability of the current state of the art in robotic catheterization will be improved. The following tasks will be conducted by the robotics group at the University of Bremen:

Learning robotic catheter skills for autonomous execution

For an autonomous surgical robotic execution, machine learning is an effective way to plan the procedure by learning from the surgeons. In the project, various machine learning techniques will be investigated to learn the different surgical skills involved in the targeted procedure. Due to requirements such as safety, reliability and accuracy, which are very important in endovascular surgery, safe interaction and efficient exploration techniques in deformable environments will be investigated.

Advanced control and decision-making for continuum robots

This task starts from a rigorous treatment of the interaction between robot and environment that considers their coupled behavior over the full length of the robot. Due to the deformable and dynamic environment, force, hybrid position-force and impedance control will be investigated for the control framework.

Further information: http://www.cascade-fb7.eu/

Project duration: 02/2013 – 01/2016

Partners:
Katholieke Universiteit Leuven (BE)
Imperial College of Science, Technology and Medicine (GB)
University College London (GB)
Materialise NV (BE)
Medyria (CH)
Zürcher Hochschule für Angewandte Wissenschaften (CH)
EndoSense SA (CH)

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