

Improving Technical Proficiency in Robot-mediated Surgery Through Counterfactual Inquiry

- **Skill is among the strongest predictors for patient outcome**
The higher surgeon skill, the better the outcome
- **Empower novice surgeons**
“Translate” beginner-level commands to expert-level proficiency
- **This is a counterfactual query**
What would the robot commands have been if, contrary to fact, the surgeon were an expert?

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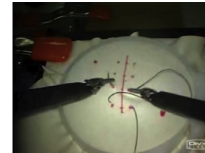
Engineering Research Center for Computer Integrated Surgical Systems and Technology



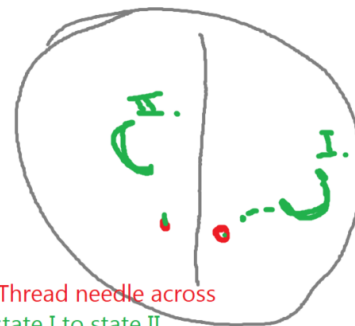
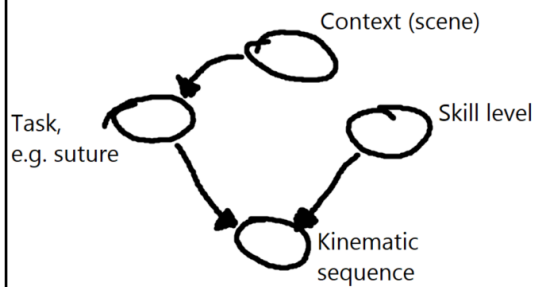
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- **This is a counterfactual query**
What would the robot commands have been if, contrary to fact, the surgeon were an expert?
- How to achieve this “translation”?



Context: Phantom and its affordances



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What Students Will Do:

- “Control for task”
Temporally align JIGSAW samples for causal analysis
- Investigate differences in novice vs. expert robot command
- Synthesize insights to implement a deep causal model for counterfactual query of expert command
- Evaluate performance and robustness of the proposed method

Deliverables:

- Minimal: Task-aligned JIGSAW dataset for causal analysis
- Expected: Insights into novice- and expert-level robot command
- Stretch: Development and evaluation of counterfactual model

Size group: 1

Skills: Python, Pytorch, computer vision, sequence modeling

Mentors: Prof. Mathias Unberath

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