ACS 2024 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting

O-05

Research Abstracts

AI Model Improvement of FLS PEG Transfer Competency After Video Annotation Optimization

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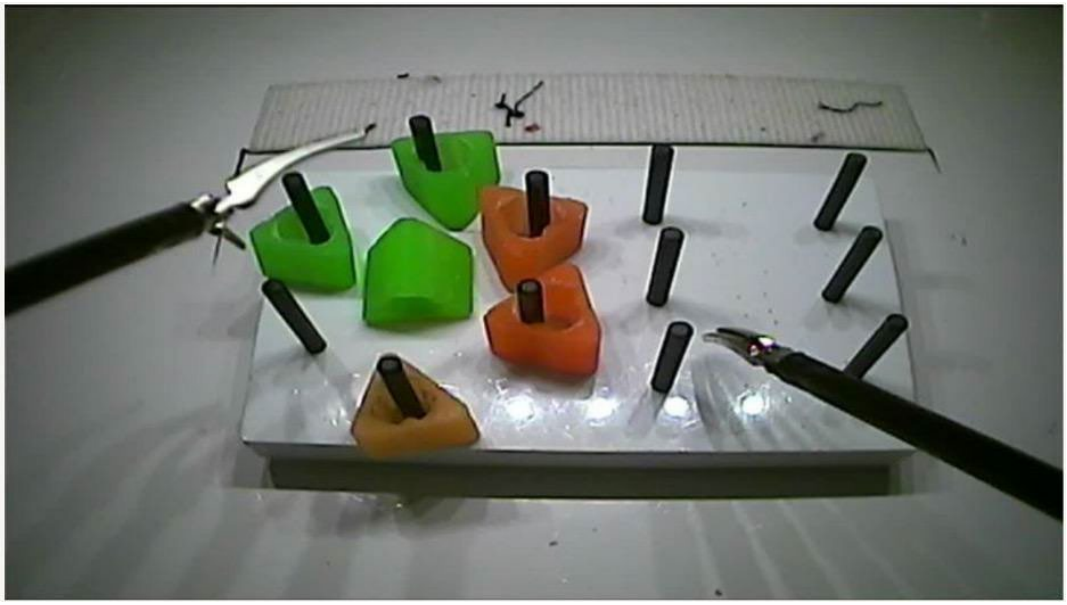
Introduction: Fundamentals of laparoscopic skills (FLS) training has become a staple of surgical education. We created a machine learning (ML) system for FLS peg transfer and experimented with methods of teaching the system to see how that would affect the overall model.

Methods: Trainees were filmed performing PEG transfers on the standard FLS simulator. Videos were fed into a cascaded neural network composed of a feature extractor and a temporal convolutional network. Three frames were analyzed to predict the action while performance was gauged on the middle frame. For model 1 videos were annotated into 6 tasks whereas for model 2 the same videos annotations were doubled into 12 tasks (Figure 1a). A standard 5-fold cross validation evaluated the model's accuracy. Accuracy was defined as correct seconds/total seconds for each task separately then averaged.

Results: N=40 videos were collected. Videos ranged from 69 to 263 seconds. The breakdown of trainees were 65% junior residents (PGY 1-2). Overall model performance calculated accuracies of each task separately, which was 41.4% for model 1 and 42.4% for model 2 (p-NS). In the granular model, rare events (Figure 1b) such as drops, picks off the board, or simultaneous picks and drops occurred only 1.3%, 3.0% and 1.7% of the time, respectively.

Conclusions: This model demonstrates a framework to evaluate surgical performance from user derived video that can be adapted for any task. During model training additional granular detail may not impact performance unless it includes more rare events.



Annotation of Videos (General vs. Granular)			
	Model 1 - General	Model 2 - Granular	P-value
Annotations of Videos	*1. Pick from ring* *2. Place on PEG* *3. Transfer* *4. Drop ring in board* *5. Drop ring out* *6. Pick from board*	*1. Pick with grasper1* *2. Hold grasper 1* *3. Place with grasper1* *4. Pick with grasper 2* *5. Hold grasper 2* *6. Place with grasper 2* *7. Transfer* *8. Drop ring in board* *9. Drop ring out* *10. Pick of drop-in board* *11. Pick of drop-out* *12. Simultaneous pick+drop*	-