

OBJECTIVE EVALUATION APPROACH OF CATHETERS AND INTERVENTIONAL MANIPULATION SKILLS

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ABSTRACT

Purpose: Endovascular catheter intervention require special instruments and manual dexterity when patient's anatomy is to be accessed via a small incision. Large number of catheters exist and new steerable catheters are under development. To evaluate the differences between those catheters on their manipulation properties as well as to evaluate interventional manipulation skills of residents, an objective measurement method is desired.

Various methods to evaluate interventional manipulation skills of residents have been developed. Most of them require human raters or are only based on elapsed time to accomplish certain tasks. We propose an objective approach to evaluate interventional manipulation skills.

Methods: To determine if certain catheter/resident is better than another, we developed the Activity Feature Vector (AFV) method and analysed the distribution of AFVs in a feature space using pattern recognition techniques.

An AFV is defined as a six dimensional vector extracted from one catheter manipulation task. Each dimension represents total time for the task of waiting, catheter rotation, catheter advancement, catheter retraction, guidewire advancement and guidewire retraction respectively. We implemented an application that is able to extract AFVs automatically from the videos of catheter manipulation. Extracted AFVs were submitted to principal component analysis (PCA) and the 1st to 3rd principal components were used to perform linear discriminant analysis (LDA). Performance of the proposed method was evaluated using a leave-one-out cross-validation.

Result: The results demonstrated that our proposed method is able to distinguish two different catheters more than 70% correctly. In addition, our proposed method showed the possibility of a combination of AFV and PCA to classify residents based on their skills.

REFERENCES

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