

Review of Sparse Hidden Markov Models for Surgical Gesture Classification and Skill Evaluation

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Sparse Hidden Markov Models for Surgical Gesture Classification and Skill Evaluation
Lingling Tao, Ehsan Elhamifar, Sanjeev Khudanpur, Gregory D. Hager, Ren Vidal

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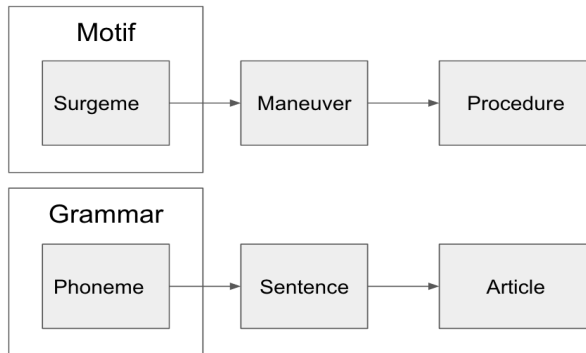
This paper proposes a new model for classifying surgical gestures using sparse dictionary learning and hidden Markov models.

With an discretely sampled motion data, the authors propose a method to classify surgical gestures.

”Given a surgery trial $\{y_t \in \mathbb{R}^D\}_{t=1}^T$, the goal of gesture classification is to assign a surgeme label $s_t \in \{1, \dots, S\}$ to each frame y_t ” [1, p. 2-3]
Similarly, the classification of a skill level involves assigning a skill level $z \in \{1, \dots, L\}$ to the whole surgery $\{y_t \in \mathbb{R}^D\}_{t=1}^T$ [1, p. 2-3].

A surgeme is a surgical gesture. Examples include inserting a needle, grabbing a needle, or positioning a needle.

A motif is made up of one or more surgemes. Motifs are like the grammar of spoken language: they constrain words to certain patterns of phonemes, the atomic sounds that make up words. In language, sounds only make sense in the context of words, and likewise a motif is a higher level description of the purpose of surgical gestures.



References

- [1] Lingling Tao, Ehsan Elhamifar, Sanjeev Khudanpur, Gregory D. Hager, Ren Vidal *Sparse Hidden Markov Models for Surgical Gesture Classification and Skill Evaluation*, Third International Conference, IPCAI 2012, Pisa, Italy, June 27, 2012., Proceedings Information Processing in Computer-Assisted Interventions, Volume 7330 of the series Lecture Notes in Computer Science pp 167-177, 2011.