Method for Improving Cooking Activity Classification Accuracy Using Location Information and Procedure Documents

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1. Utility of Location Info and Procedure Docs for Activity Classification

The integration of **location information** allows for the filtering of recognized activities
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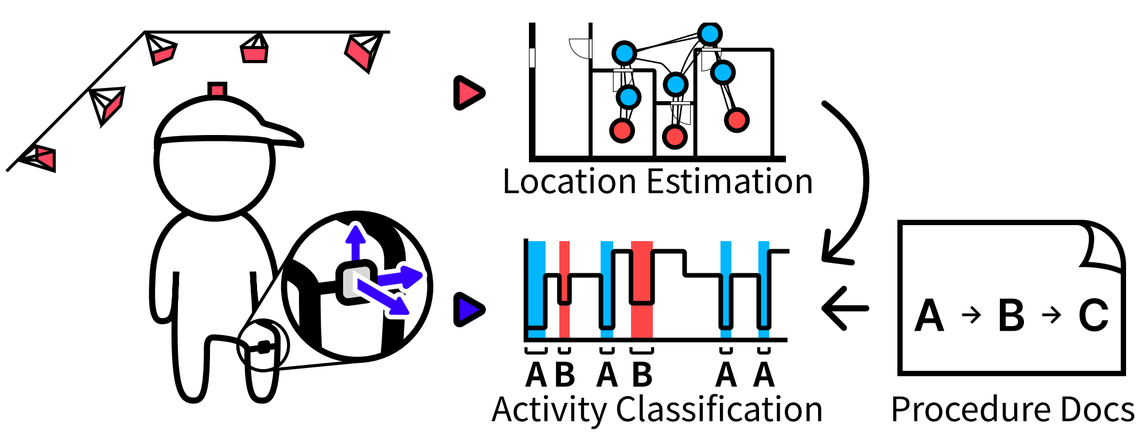
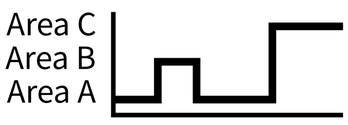
The integration of the **procedure documents** allows for the filtering of recognized activities



Activity can be refined by location information and Procedure Documents

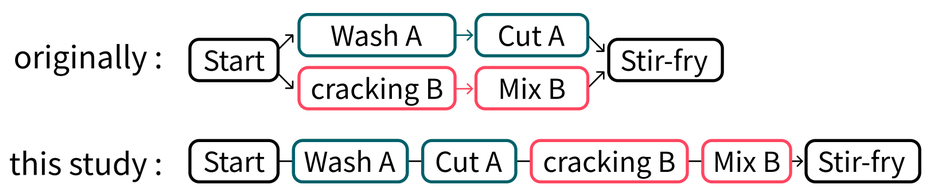
2. Limitations

Limitations of Location Information



Manually defined based on video recordings

Limitations of the Procedure Document



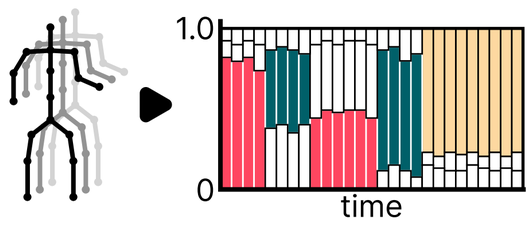
3. Cooking Activity Classification with Location Information

Sensing with Motion Capture

Using **mocopi** for motion capture

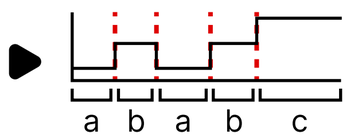
A six-point sensor setup enables the acquisition of **skeletal and location data**

Machine Learning (XGBoost)



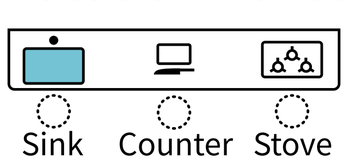
Extracting features
- maximum • mean
- minimum • variance
- standard deviation

Frame Integration



Integrate frame-by-frame results into activity units

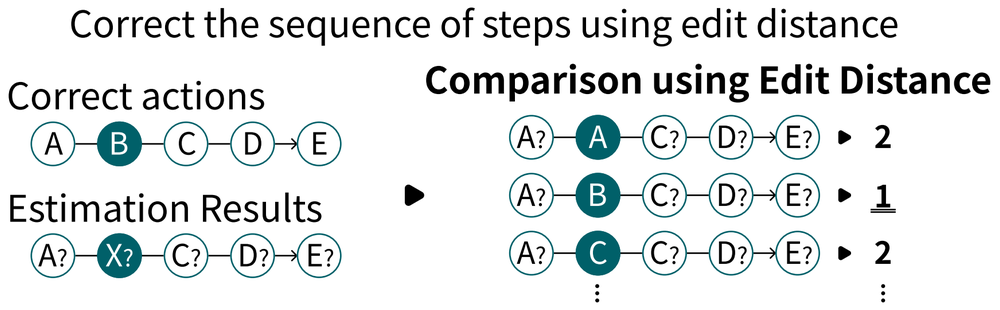
Location-Based Refinement



Constrain the possible actions using location information

Procedure-Based Refinement

Correct the sequence of steps using edit distance



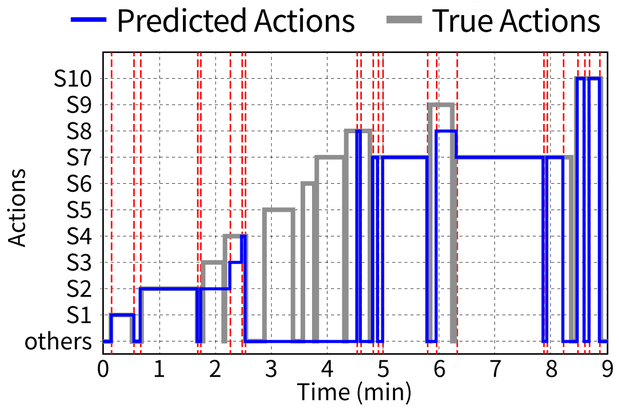
4. Experiments

Purpose : Accuracy comparison for each stage
Task : Cooking fried rice
Training : 20 trials (7 participants); Test: 1 trial (1 participant)

Cooking Activities

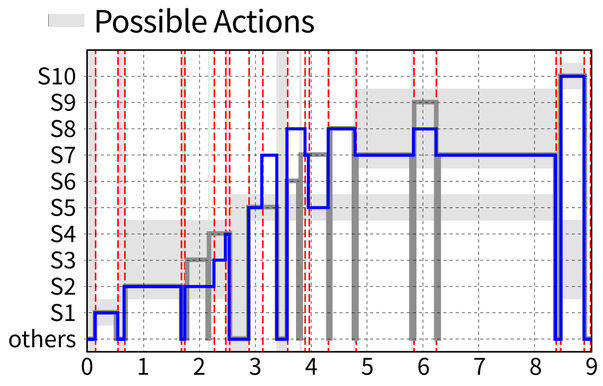
S1. washing green onion	S5. oiling the pan	S9. seasoning
S2. chopping green onion	S6. pouring the egg	S10. plating
S3. cracking an egg	S7. stir-frying	others
S4. beating an egg	S8. adding ingredients	

A. After Frame Integration



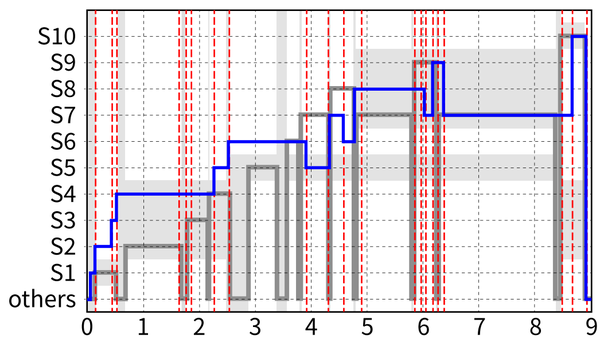
○ Acquiring duration and process Order
✕ One activity split into multiple parts
✕ Multiple activities merged into one

B. Refinement with Location Only



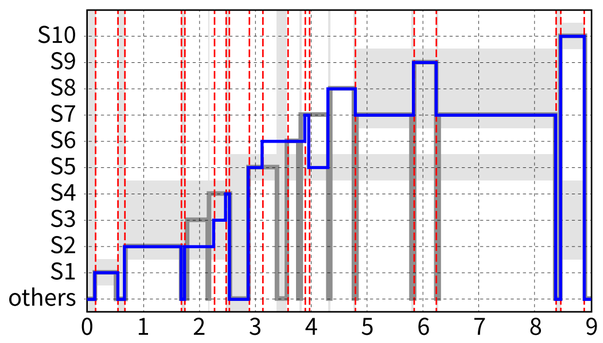
○ More accurate process duration
✕ The steps are out of order

C. Refinement with Procedure Only



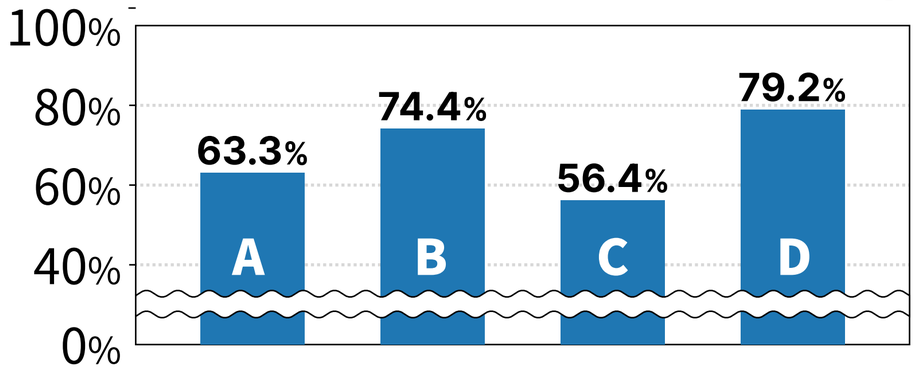
○ Refined by process order
✕ Inaccurate process duration

D. Refinement with Location and Procedure



○ More accurate process duration
○ Refined by process order

Accuracy comparison for each stage



Accuracy was enhanced by refining activity recognition using location information and the procedure document

5. Future Work

Perform actual position estimation and apply it complementarily with activity recognition

Refinement based on **standard task durations**

Consider a **more realistic reordering** of steps