

Abbreviation for In-store Item Interaction Identification System
Pronounced as I-foresee

I⁴S: Capturing Shopper's In-store Interactions

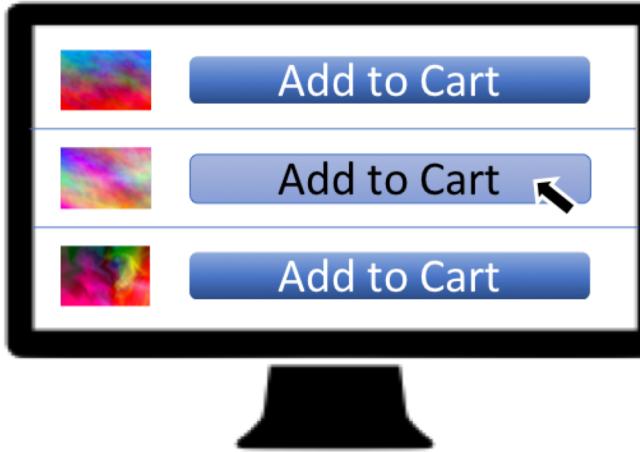
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MOTIVATION

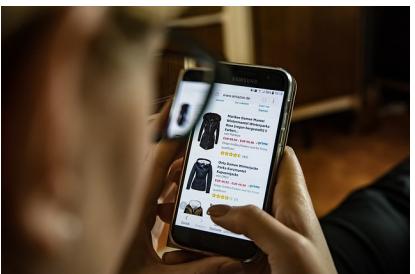


In-store Shopping



Online Shopping

Similar to online stores, can a physical store owner achieve fine-grained information about a shopper's interest?

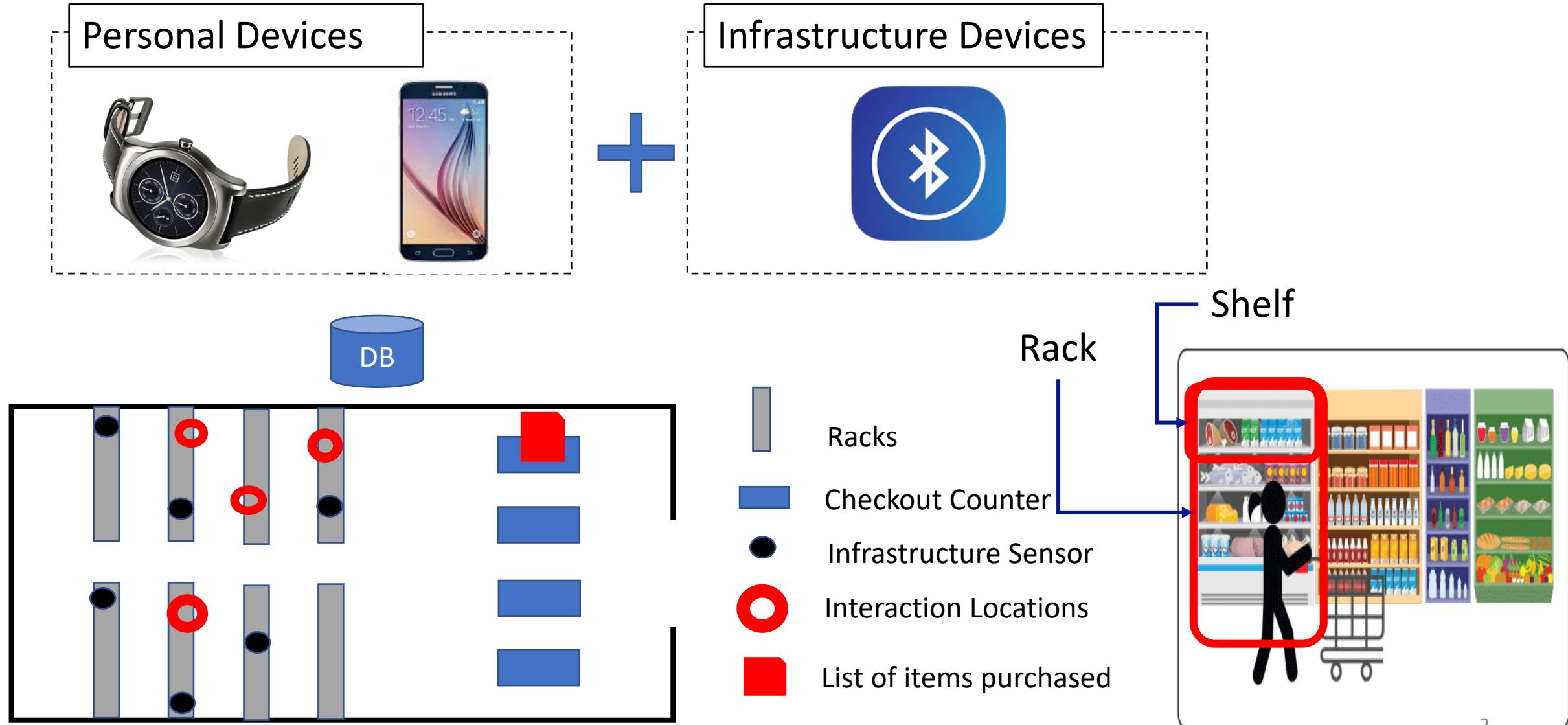


Recommendations



Offers

OUR SOLUTION: I⁴S



I⁴S: WORKING



Shopper Walking in store

- Smartphone monitors locomotion state through inertial sensing



Shopper Reaches for Item

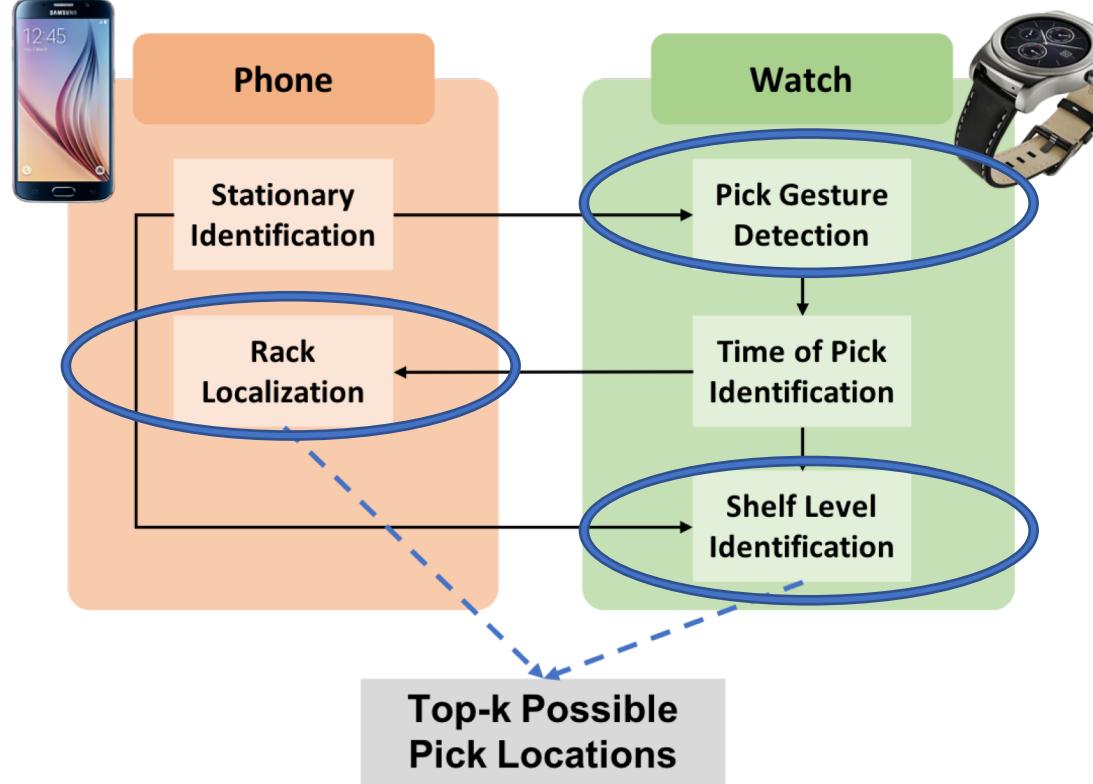
- Smartwatch identifies shelf level through inertial sensing
- Smartphone identifies sit/stand through inertial sensing



Shopper Stands near a Rack

- Smartwatch identifies pick gesture through inertial sensing
- Smartphone identifies in-store location through BLE scanning

I⁴S: WORKING



FIELD STUDY

Store: Book store in University campus

Instrumentation: 35 BLE beacons deployed in store

- Location: foot of the rack
- Transmission details: power -20dBm, interval 101 ms

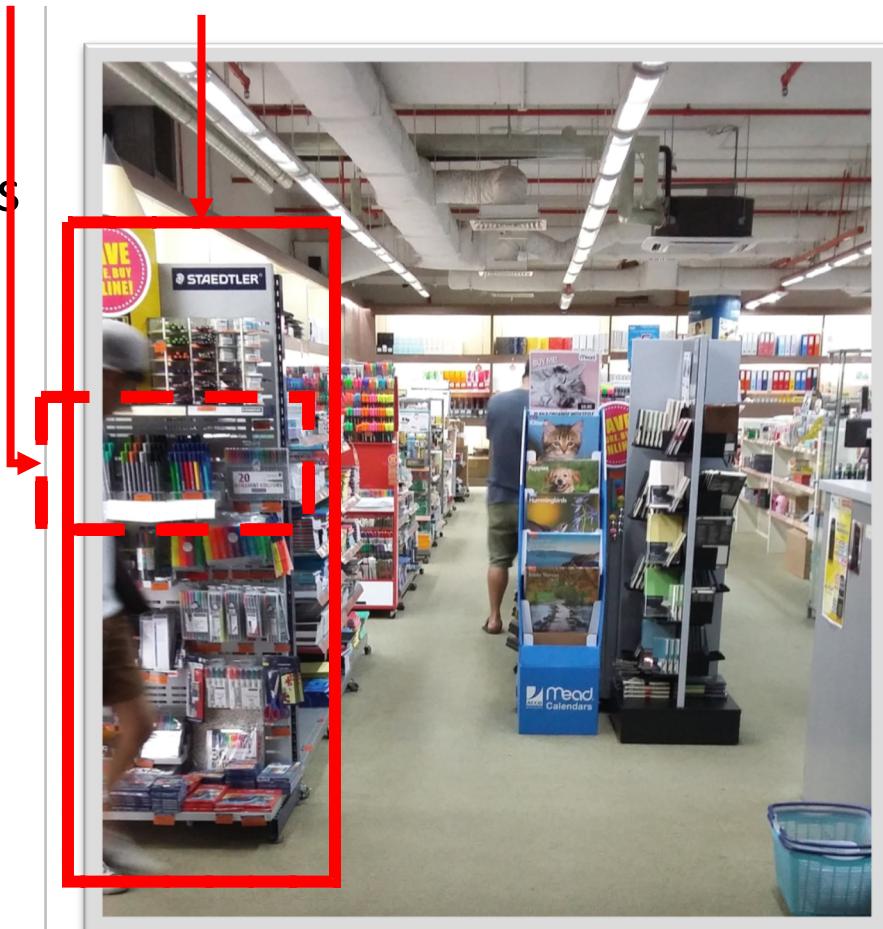
Participants: 31 students from the university

- Devices used: smartphone and smartwatch
- Sensor data: inertial sensor, BLE scan

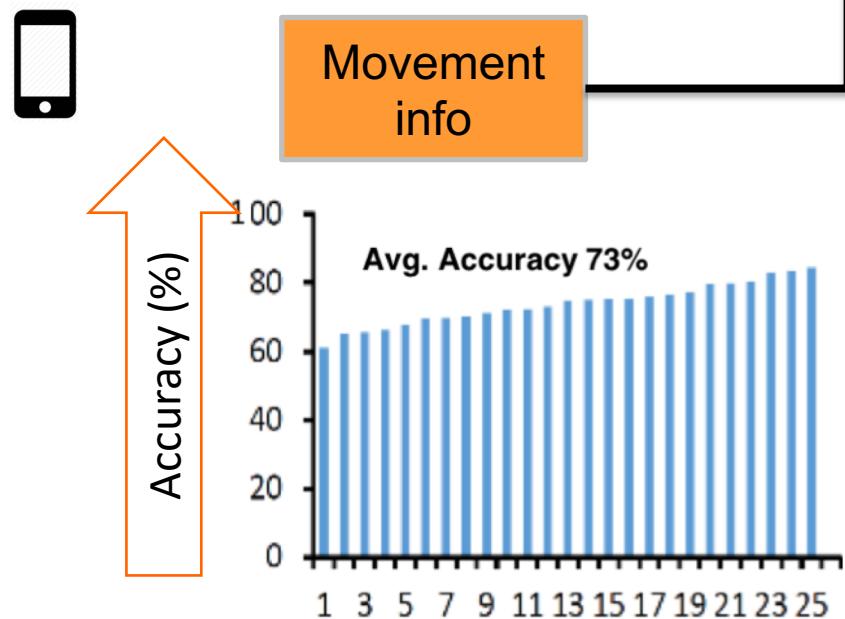
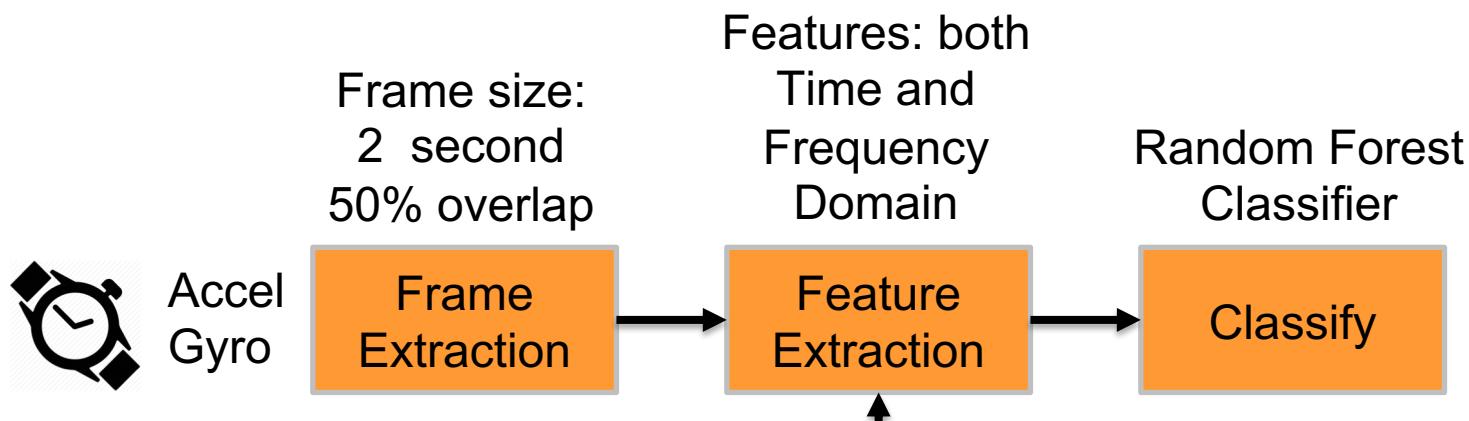
Episodes: 25 out of 31 used

- # picks extracted: 778
- # racks : 43
- Rack length: 1 meter, Shelf height: 30 cm

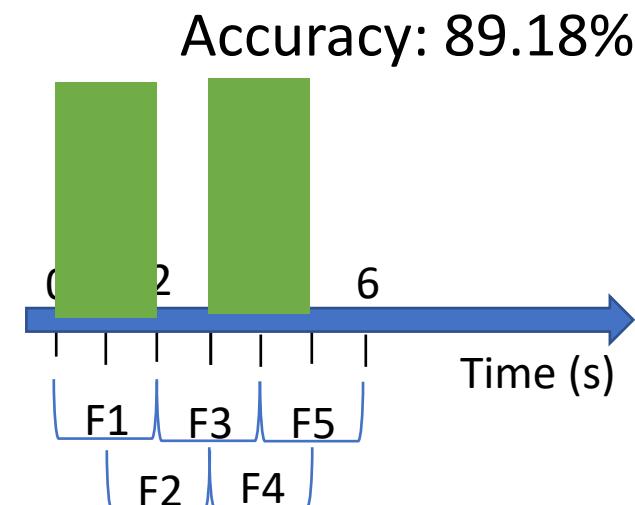
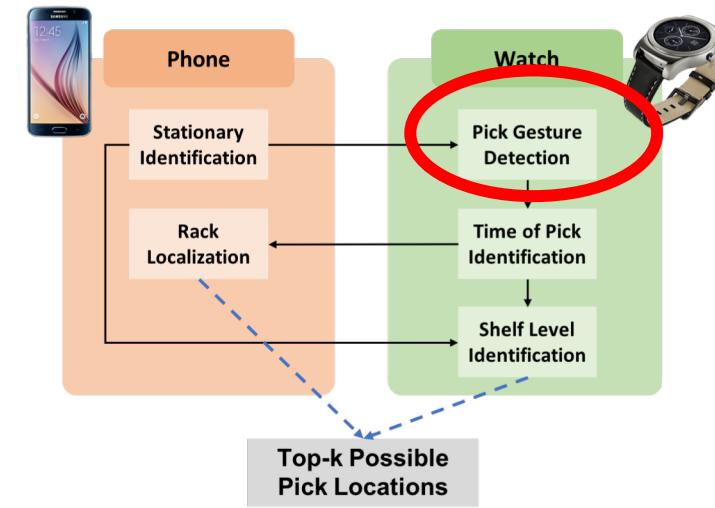
SHELF RACK



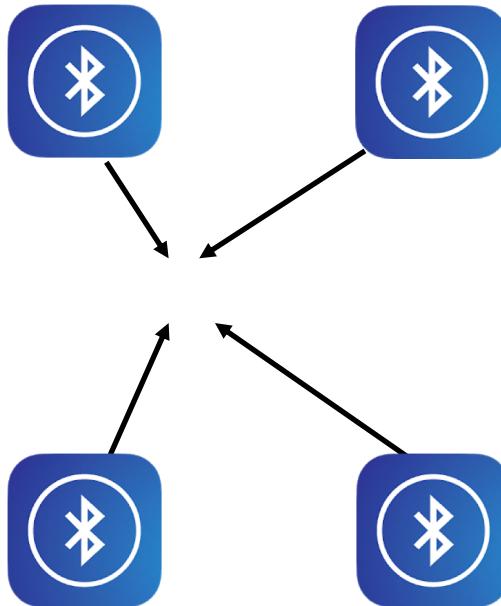
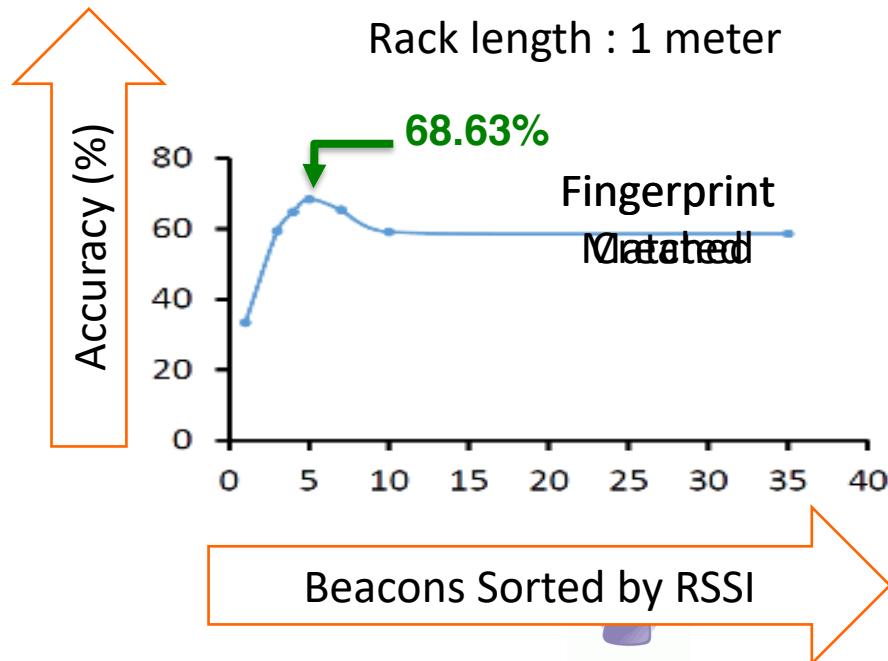
PICK DETECTION



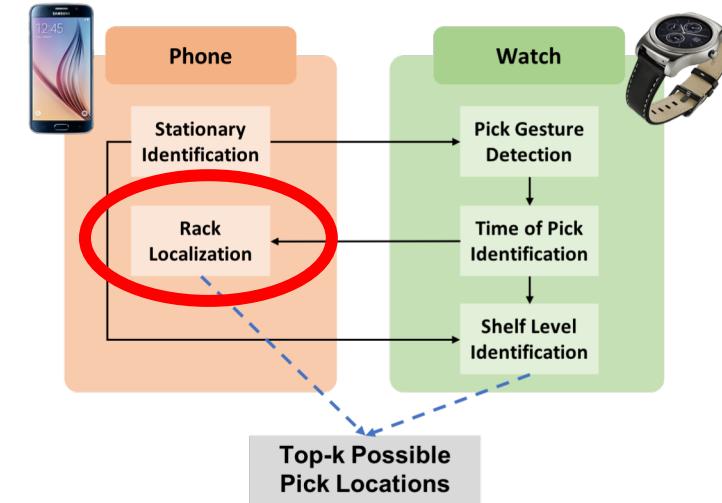
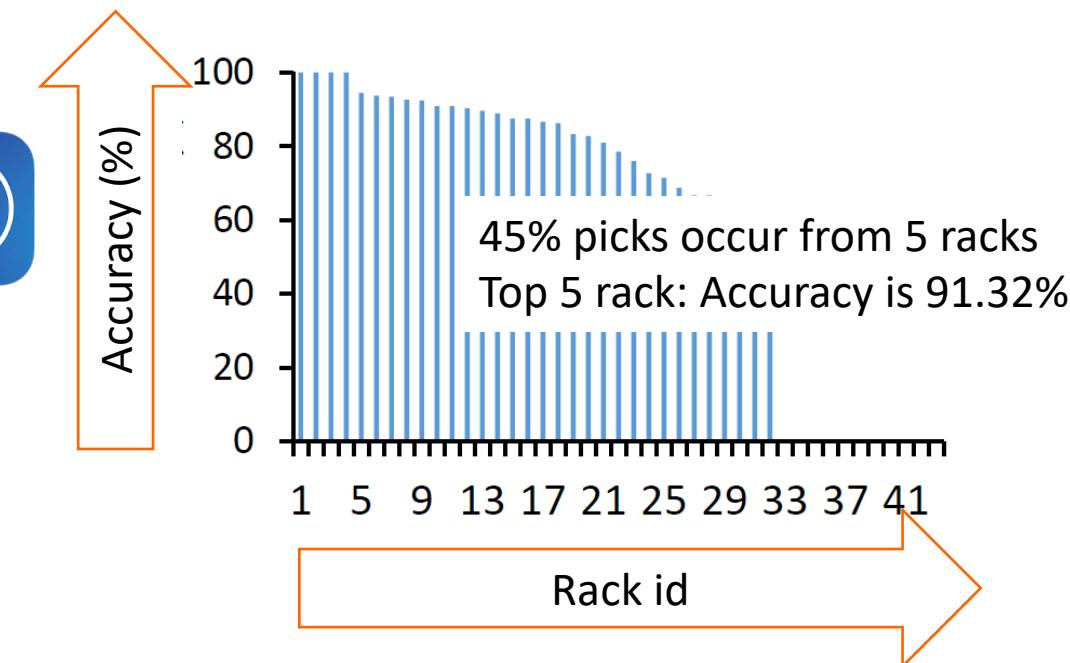
Participant Id



RACK LOCALIZATION



Viterbi smoothing (*depth=4*) improves the rack level localization accuracy to **85.47%** during picking.



SHELF DETECTION



Frame Extraction

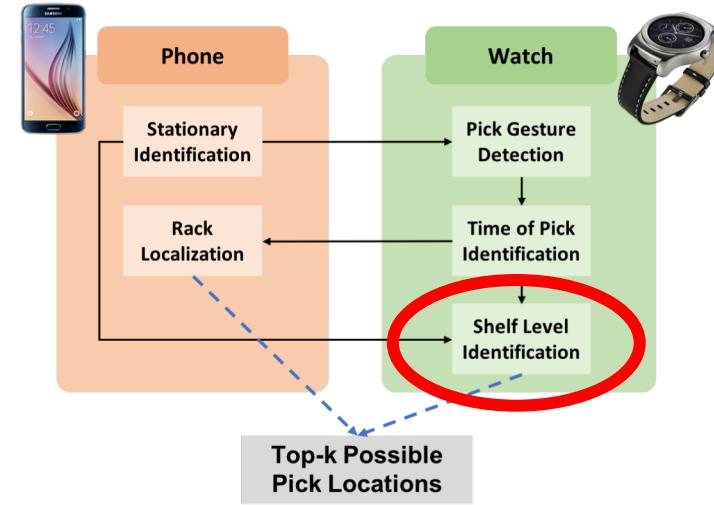
Feature Extraction

Classify



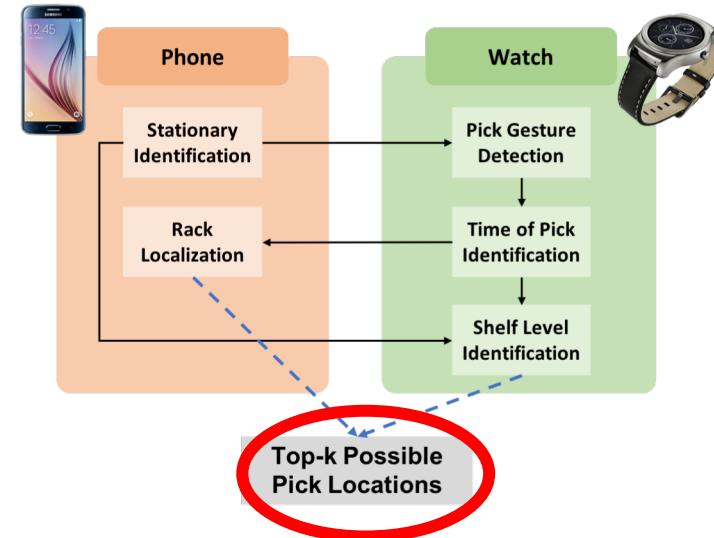
Sit / Stand

**10 fold cross validation
accuracy – 89.07%**



OVERALL PERFORMANCE

	Accuracy
Pick Detection	89.18%
Top 5 rack localization	91.32%
Shelf Identification	89.07%



I⁴S Accuracy: $0.892 \times 0.913 \times 0.891$

$$= 72.53\%$$

In 73% cases, the shopkeeper could know which is the shelf-of-interest for the shopper.

SUMMARY

- We Introduce I⁴S , a multimodal sensing technique for shopper's in-store activity monitoring
- Using sensor data from smartwatch and smartphone, we:
 - Can detect the **pick gesture** with 89.18% accuracy
 - Can **localize** these picks to **racks** with 91.32% accuracy
 - Can **detect** the **shelf** of interest with 89.07% accuracy
- Overall system accuracy of I⁴S is 72.53%

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