

On Utilizing Smartphone Cameras to Detect Counterfeit Liquid Food Products

Bangjie Sun, Sean Rui Xiang Tan, Zhiwei Ren, Mun Choon Chan, Jun Han*



NUS
National University
of Singapore



Project
Website

1. Problem

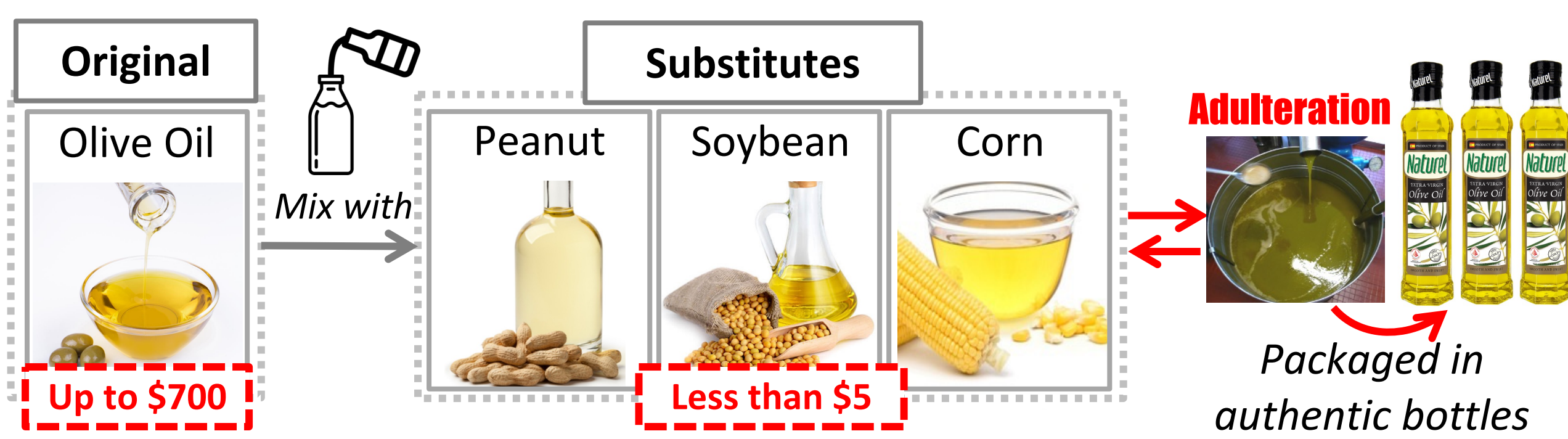
Counterfeit Liquid Food Products:

- Widespread and dangerous
- Difficult to detect by an average consumer



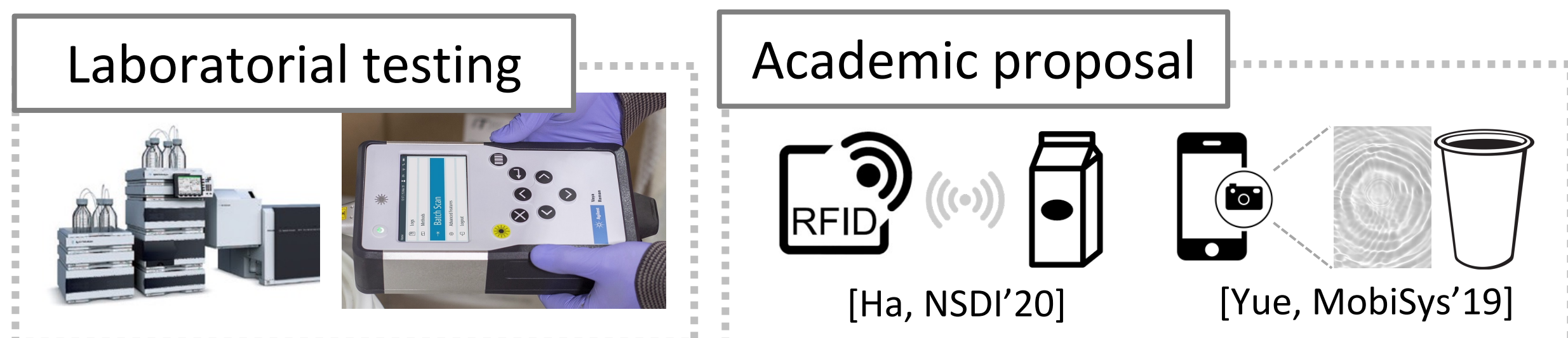
Adulteration is Main Source of Counterfeits

- Replace a large portion of liquid with substitutes
- Package in authentic bottles and seal to standards



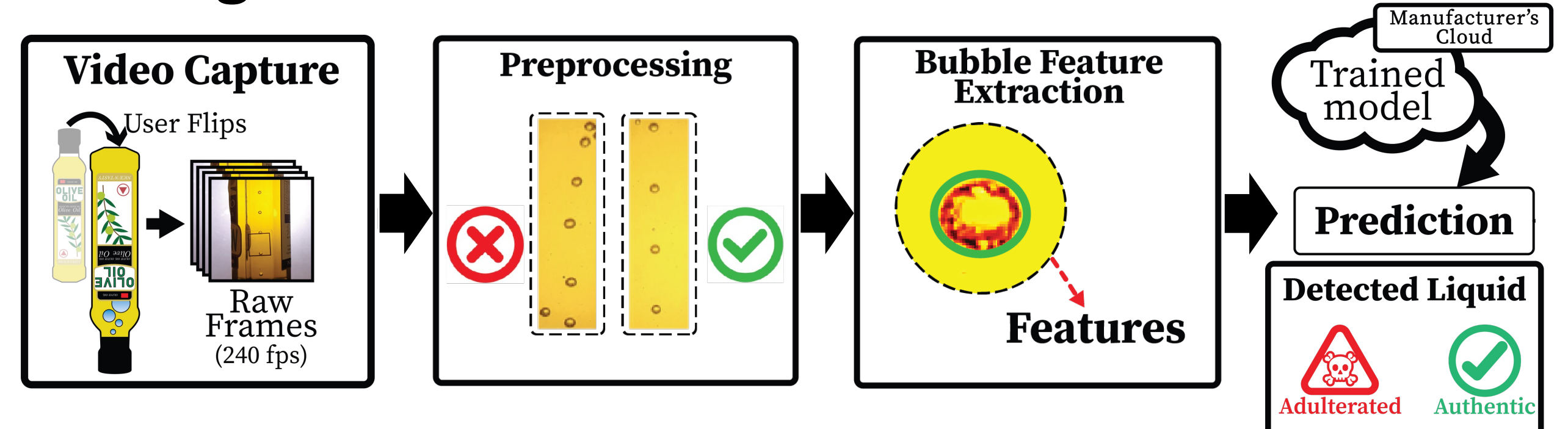
State-of-the-art Solutions are Limited

- Require costly and specialized equipment
- Require opening of bottles and controlled settings



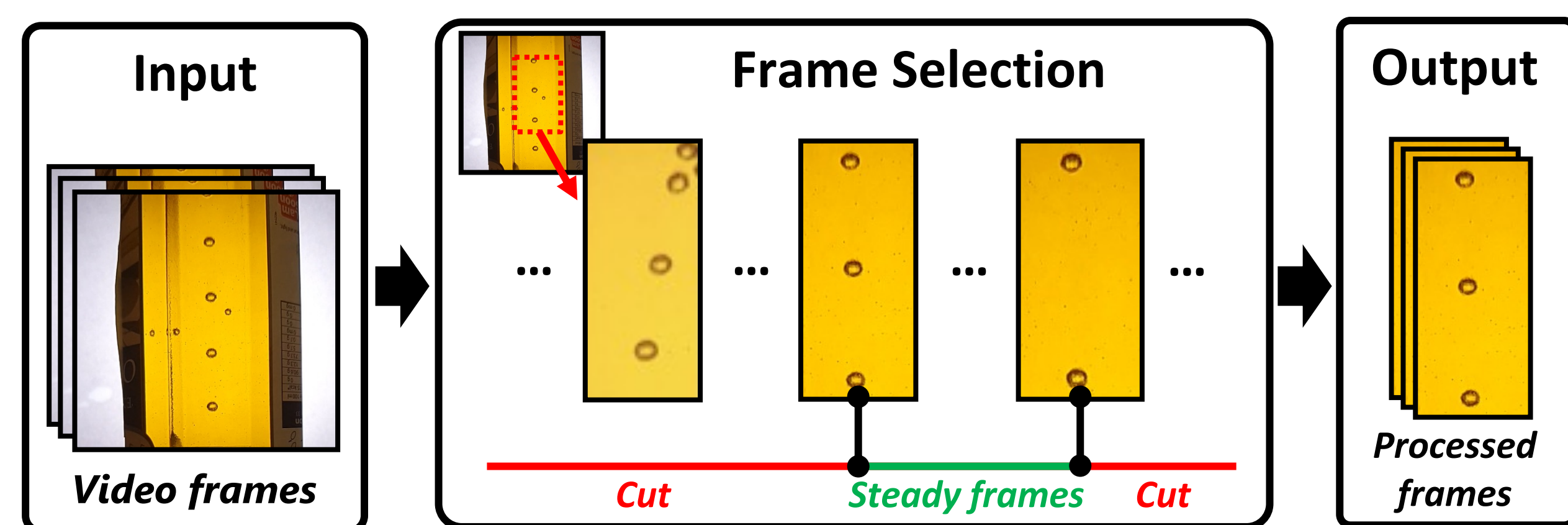
3. System Design

Design Overview



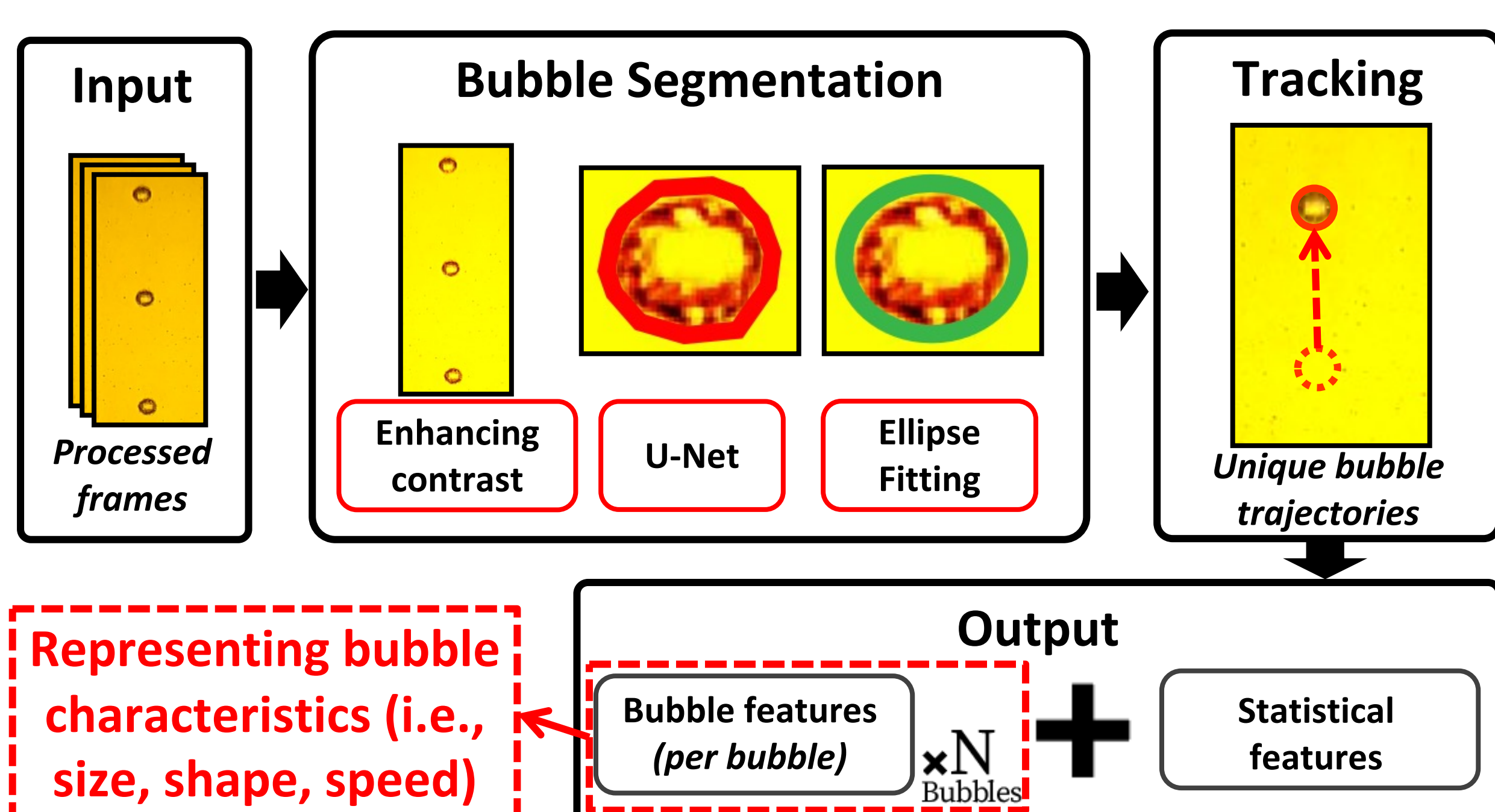
Pre-processing Module

- Filter video frames using image processing techniques
- Obtain bubble characteristics consistent across tests



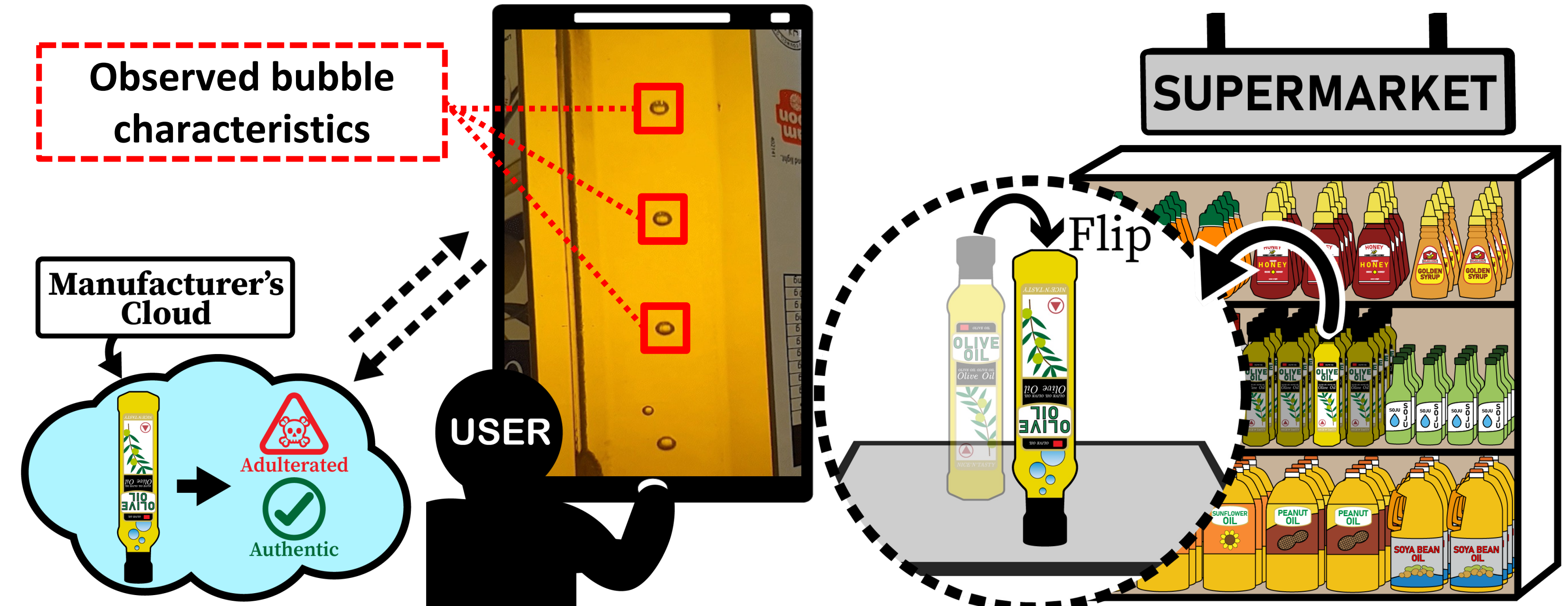
Bubble Feature Extraction Module

- Obtain fine-grained bubble segmentation
- Extract distinguishable features for machine learning



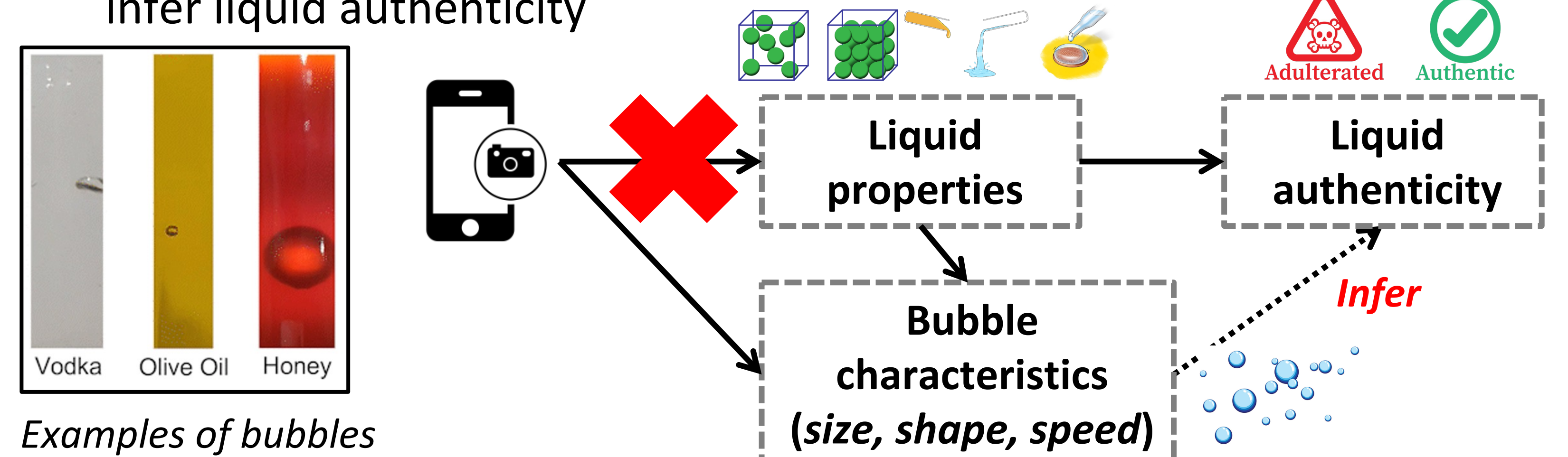
2. Our Solution: LiquidHash

- Verifying authenticity of liquid food products **without opening bottles** and **using only smartphone cameras**



Insights

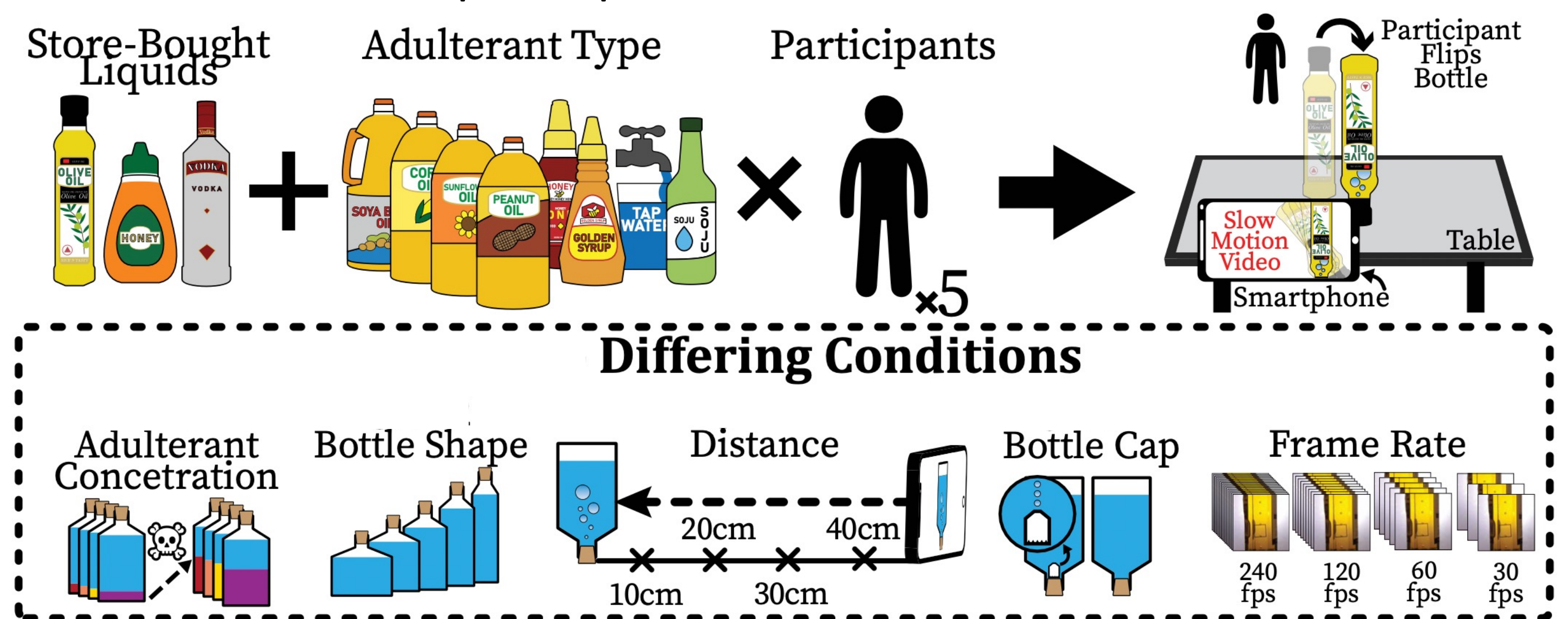
- Each type of liquid has unique liquid properties
- Direct measurement is impractical with smartphone cameras
- Utilize observed bubble characteristics -- size, shape and speed -- to infer liquid authenticity



4. Evaluation

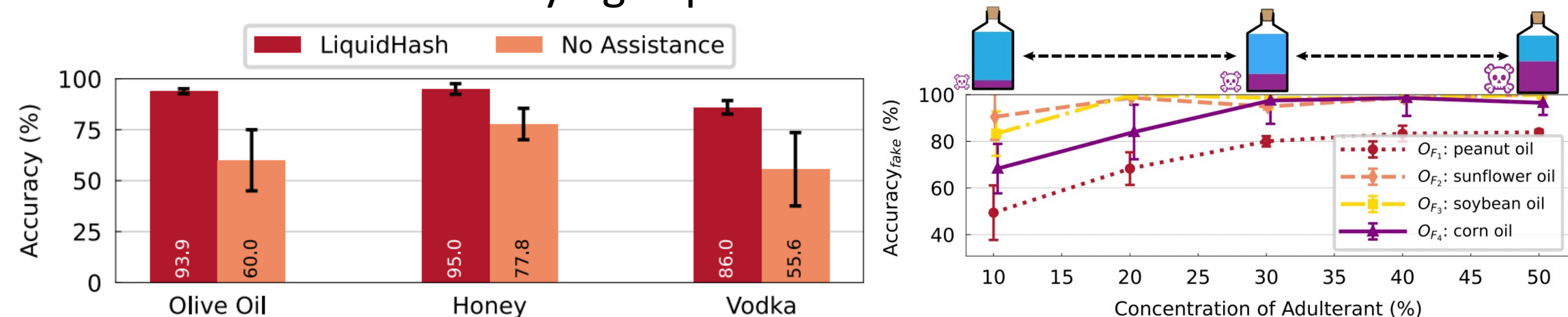
Experiment Setup

- 11 instances of authentic and adulterated liquids
- 350 tests across 5 participants



Performance of LiquidHash

- Achieve overall detection accuracy up to 95%
- Generalize across varying experimental conditions



5. Discussion

Deployment Considerations

- Verifying product integrity in supply chain
- Upload videos to servers for verification

Limitations

- Powerful counterfeiters
- Opaque bottles and liquids

