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WINLAB | Wireless Information Network Laboratory

Mobile Sensing System

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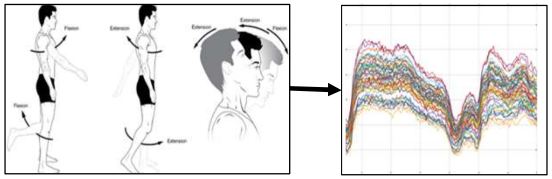
Background

- Channel State Information (CSI) based application
  - WiFi channel response varies according to human movements
  - CSI can be used to train deep learning model for classification



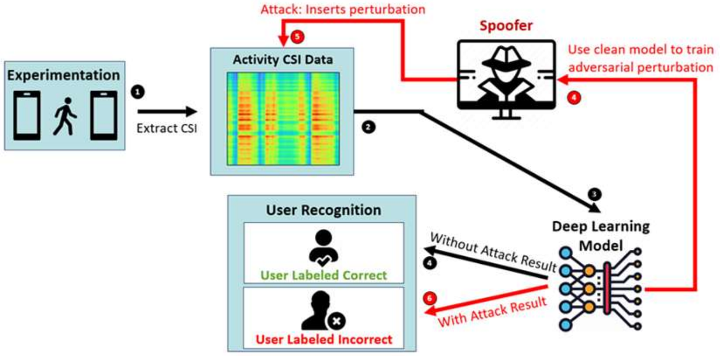
- Adversrial attack against WiFi sensing
  - CSI sample can be modified by adversarial perturbation to deceive the DNN model
  - Targeted universal perturbation: Users do kicking, but the model only recognize as walking

Objective

- Study the Security of WiFi sensing systems under adversarial attack
- Utilize mobile device to extract channel state information (CSI) to train deep learning model for recognition tasks
  - Human Activity Recognition and User Authentication
- Develop a type of adversarial attack algorithm to generate perturbation that can deceive the deep learning model

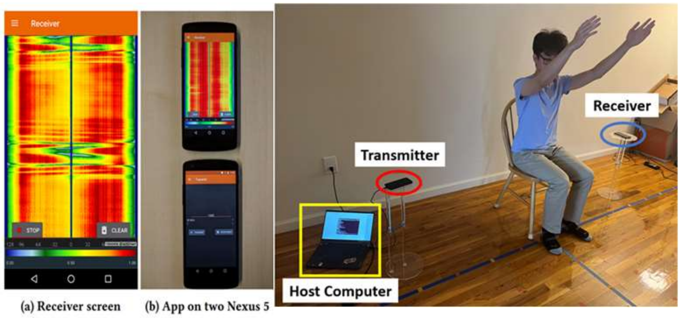
Main Challenges

- Extracting CSI from Mobile Devices
  - Nexus phones were not connecting to Wi-Fi
- Building an efficient and robust model trained by input CSI
- Generating an effective adversarial attack against the model



Experiment Procedure

- Set up mobile phones on Linux system, and enable the ability to extract Channel State Information (CSI)
- Used two mobile phones to transmit and receive WiFi packet
  - Receiving Nexus 5 extracts CSI data from the kernel
  - Performed daily movements such as: Walking, squatting, raising arms, kicking, sitting

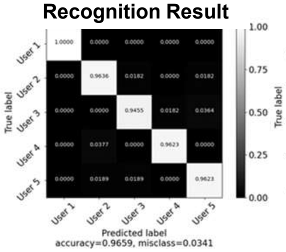


(a) Receiver screen (b) App on two Nexus 5

Results

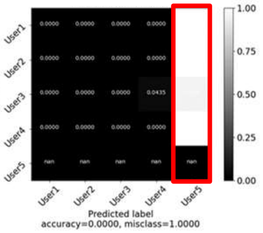
- Clean Model Recogniton Result
  - Model is able to achieve recognition accuracy at 96% for User authentication
- Attack result on User Authentication
  - Overall attack success rate can reach to 80%

Clean Model Recognition Result



accuracy=0.9659, misclass=0.0341

Attack Result for User 5



accuracy=0.0000, misclass=1.0000

Future Work

- Run more experiments on other humans to increase user authentication accuracy
- Attack testing on Human Activity Recognition

Acknowledgements

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Reference

[1]Carlini, Nicholas, and David Wagner. "Towards evaluating the robustness of neural networks." 2017 ieee symposium on security and privacy (sp). Ieee, 2017.

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