Demo: Detecting Group Formations using iBeacon Technology

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1. INTRODUCTION

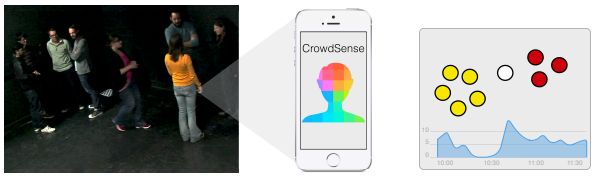
Researchers from different disciplines have examined crowd behavior in the past by employing a variety of methods including ethnographic studies, computer vision techniques and manual annotation based data analysis. However, because of the inherent difficulties in collecting, processing and analyzing the data, it is difficult to obtain large data sets for study. In this work we present a system for detecting stationary interactions inside crowds, depending entirely on the sensors available in a modern smartphone device such as Bluetooth Smart (BLE) and Accelerometer. By utilizing Apple's iBeacon™ implementation of Bluetooth Smart using SensingKit[1], our open-source multi-platform mobile sensing framework [1], we are able to detect the proximity of users carrying a smartphone in their pocket. We then use an algorithm based on graph theory to predict group interactions inside the crowd. Previous work in this area has been limited to the detection of interactions between only two people and therefore our approach goes beyond current state of the art in its ability to detect group formations with more than two people involved. Our approach is particularly beneficial to the design and implementation of crowd behavior analytics, design of influence strategies, and algorithms for crowd reconfiguration.

2. DEMONSTRATION

As shown in Figure 1, our system consists of: an iOS mobile application titled CrowdSense[3], and a cloud-based server back-end. Each user needs to have CrowdSense installed, enabling his/her device to both broadcast as an iBeacon™, but at the same time scan for other beacons around the space. The app is also collecting the Linear Acceleration of the device, classifying the user's motion activity between 'stationary' and 'in motion'. Our back-end receives the data in real-time and visualizes the detected group formations though a web interface. Additionally, it produces analytics about the detected crowd such as: types of interactions over time, clustering and degree distributions. For more information about how our technology works, please refer to [2].

Our setup includes some iPhone devices with the CrowdSense app installed, that will be given to people interested in our demo. Since CrowdSense is available in the AppStore, users could also use their personal devices to participate. The back-end will analyze the streamed data, detect the users' social interactions in real-time and visualize them on a screen through a web-interface. A video recording of an actual social event (e.g. a conference coffee break) will also be displayed on another screen, while our system will analyze more complex scenarios of interactions happening in that event.

The purpose of this demo is to present a technology that is capable of providing in-depth analytics about how the crowd behaves during social events. A video showcase of the demo can be found at: https://www.sensingkit.org/MobiSys17-Demo.m4v.



a. Example of a social event b. CrowdSense App c. Back-end

Figure 1: System Design

[1]https://www.sensingkit.org

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3. REFERENCES

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