

# Characterizing Wearable SmartID Badges for the Analysis of Social Interactions

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## 1 Background

- Automatically capturing human interactions and interpersonal relationships is difficult
- Personal proximity can indicate an essential aspect of the relationship between people and their character traits
- An F-formation is a group of people who actively try to maintain a mutual space where everyone can fully perceive each other. Having access to both verbal and non-verbal cues.
- received signal strength indicator (RSSI) of Bluetooth devices can be used to create a rough but easy to implement estimation of relative distance, aka proximity

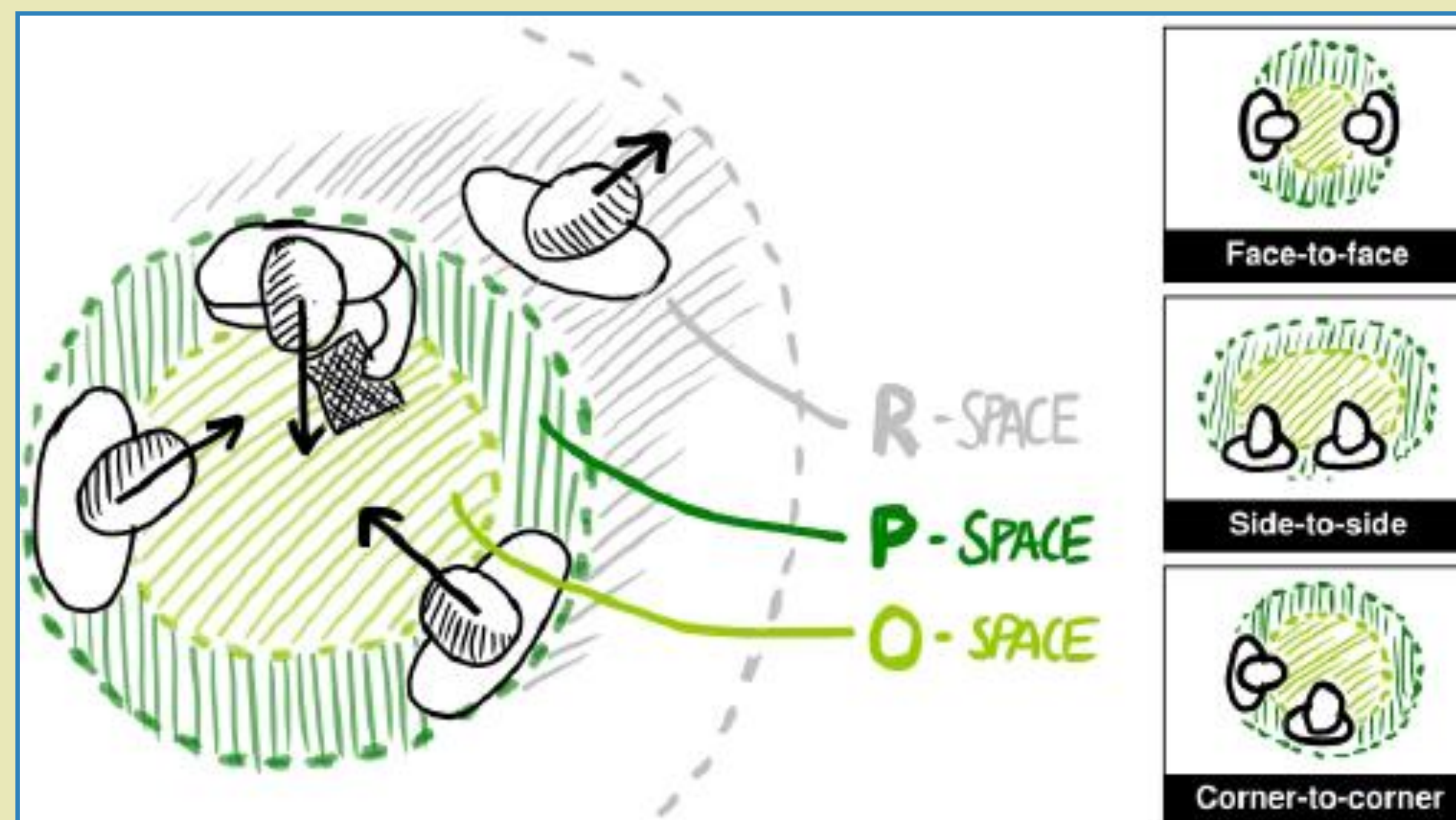


Figure 1: An F-formation consists of two or more persons engaged in joint activity. Their bodies define three, roughly circular, regions: the inner o-space, the ring of p-space, and the surrounding r-space. [1]

## 2 Research question

What is the F-measure of identifying F-formations using Bluetooth proximity data and ground-truths from the Conflab dataset?

## 3 Methods

- Extract Bluetooth proximity data from the Conflab dataset of people included in the ground-truths (1Hz) at that time
- Pair-wise affinity between all people is created depending on the parameters
- From the pair-wise affinity, generate a matrix and reduce the problem to one from graph-theory
- Use dominant-set clustering to extract F-formations
- Calculate the F-measure using the extracted F-formations and ground-truths

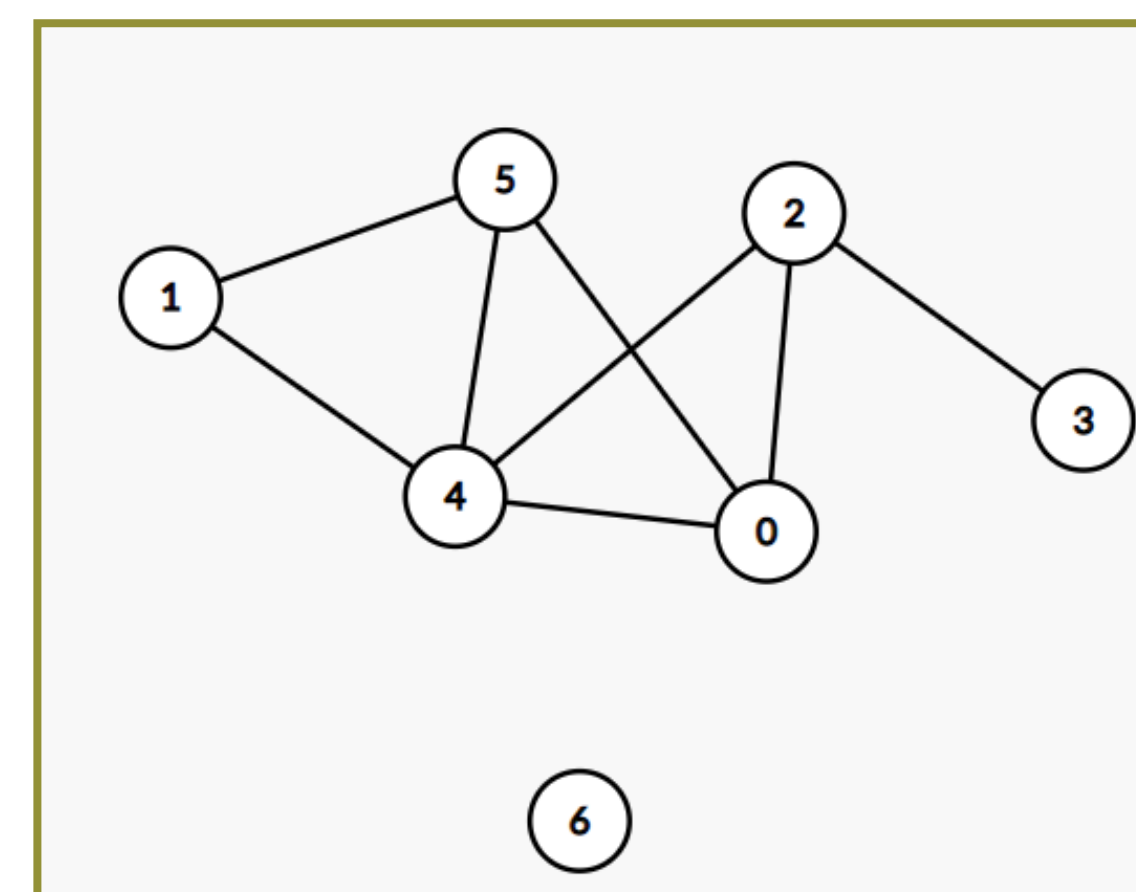


Figure 2: Example graph, what are the clusters?

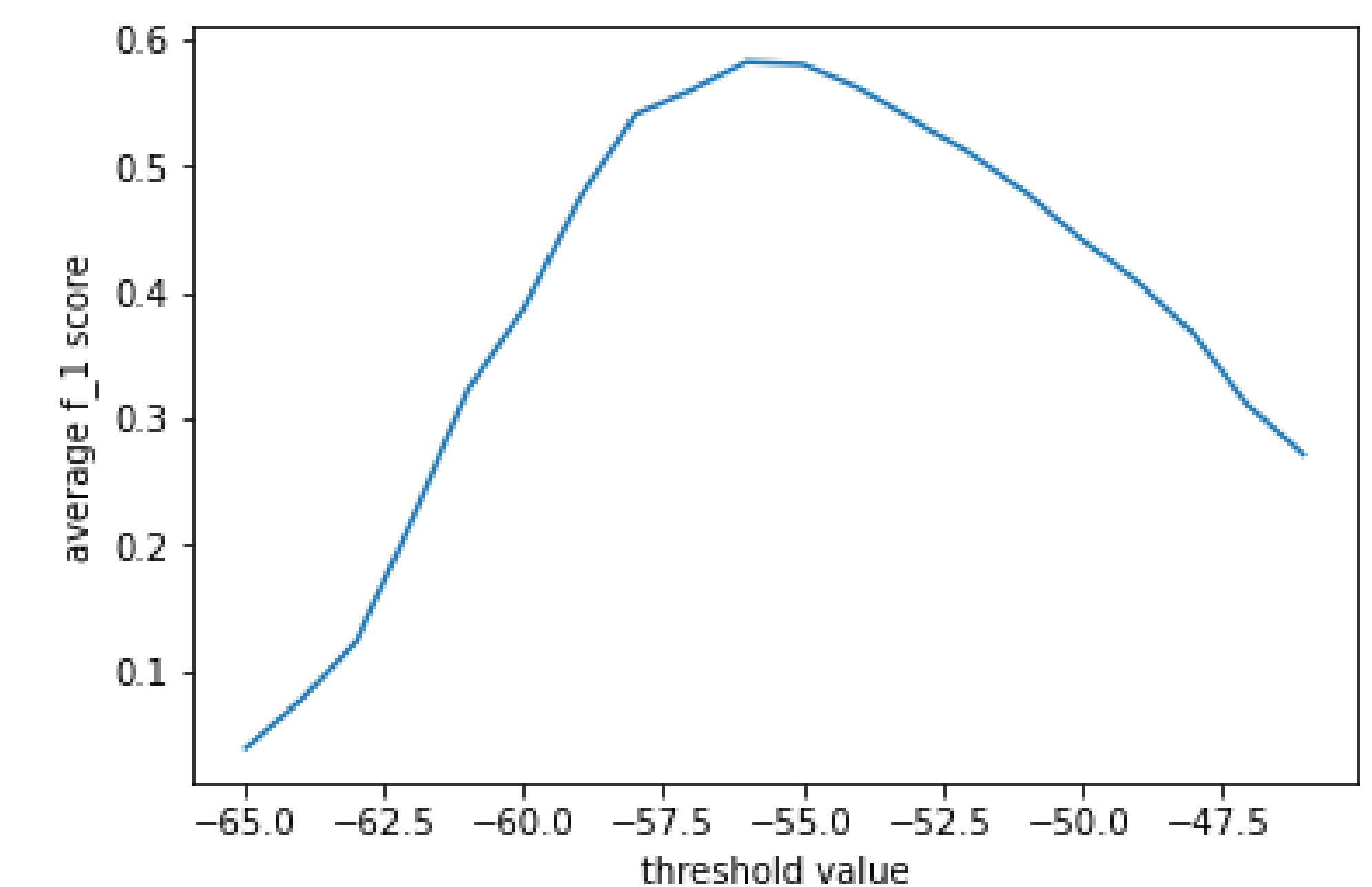
### Parameters:

Symmetrizing using min or max  
Maximal time difference between annotated frame and measured RSSI  
Reconstruct missing data  
Feature engineering (selecting an RSSI cut-off)  
Calculate event labels

## Important terms

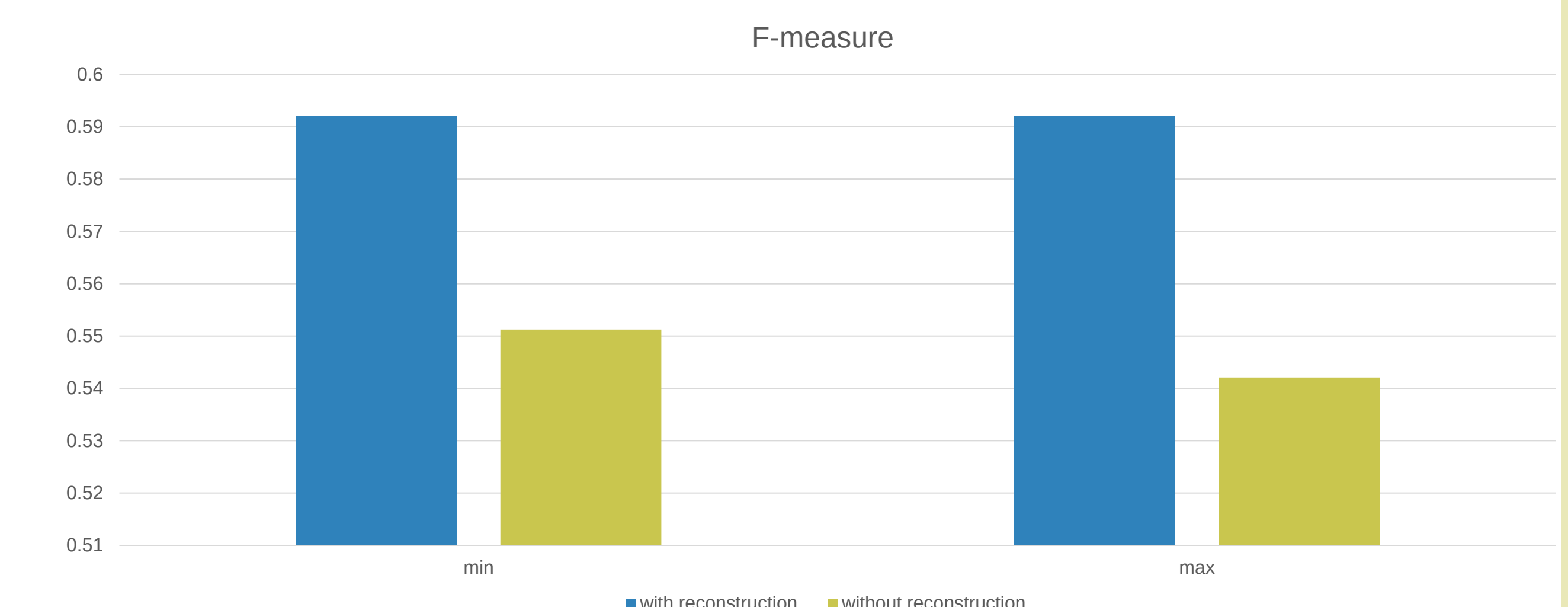
- F-measure or F-score is the harmonic means of precision and recall.  $f_1 = \frac{true\ positive}{true\ positive + \frac{1}{2}(false\ positive + false\ negative)}$
- True positives: correctly detected groups
- False positives: detected groups that do not exist
- False negatives: are groups that have not been detected
- Conflab is the dataset gathered from a mingling event by the Socially Perceptive Computing Lab at the TU Delft. The data was captured using a badge (including acceleration, BLE proximity, low-frequency audio) around their neck and video cameras
- Ground-truths manually annotated F-formations from the Conflab dataset. Created every second of the event

## 4 Results and conclusion



Graph 1: F-measure, with reconstruction, time-difference max: 30s, using symmetrisation with min

- F-formation detection using Bluetooth proximity data from the Conflab dataset performs better with the usage of reconstructed data averaging to 0.592



## References

1. Cross-device interaction via micro-mobility and F-formations - Scientific Figure on ResearchGate. Available from: [https://www.researchgate.net/figure/An-F-formation-consists-of-two-or-more-persons-engaged-in-joint-activity-Their-bodies\\_fig1\\_262153761](https://www.researchgate.net/figure/An-F-formation-consists-of-two-or-more-persons-engaged-in-joint-activity-Their-bodies_fig1_262153761)