Human Activity Recognition using Skeleton Data from RGBD Sensors

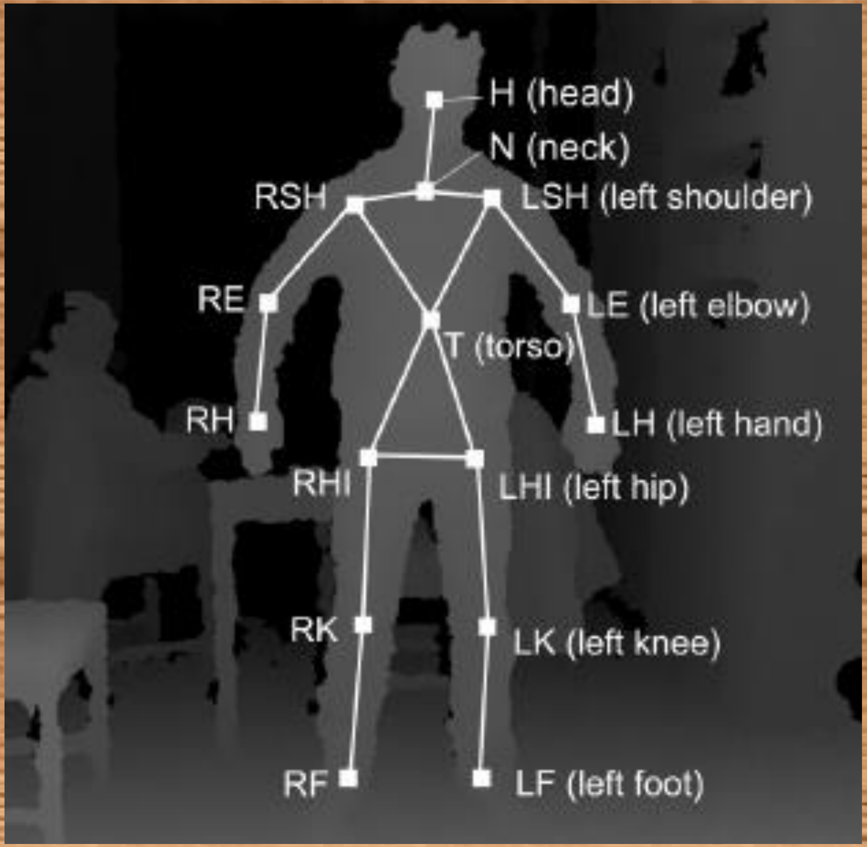
Authors:

Enea Cippitelli

Samuele Gasparrini

Ennio Gambi

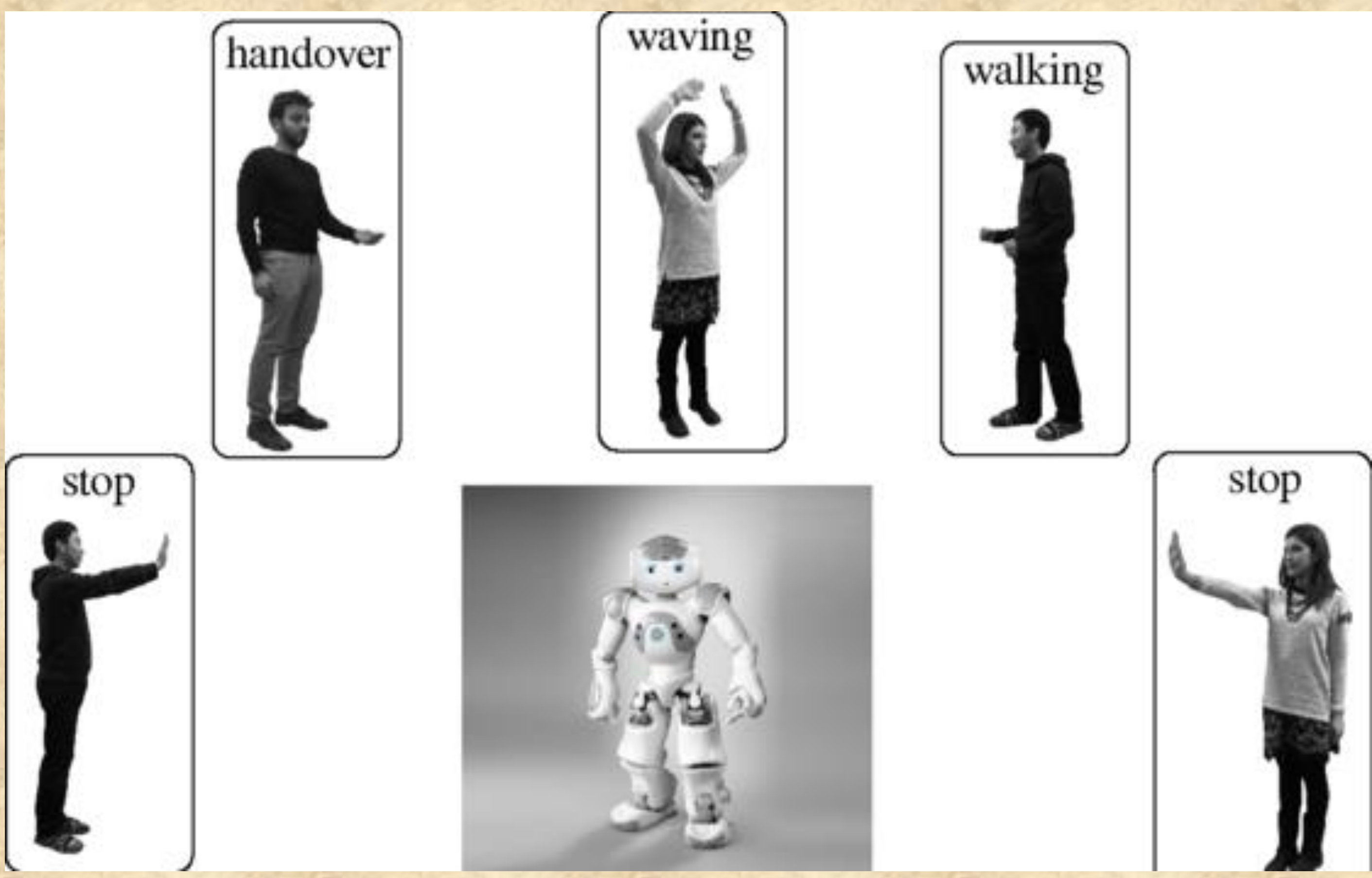
Susanna Spinsante



-Presented By: Dhanesh Pradhan

Overview: Problem Statement

Develop Human Activity Recognition Algorithm exploiting skeleton data extracted by RGBD sensors



Overview: CAD-60 Dataset

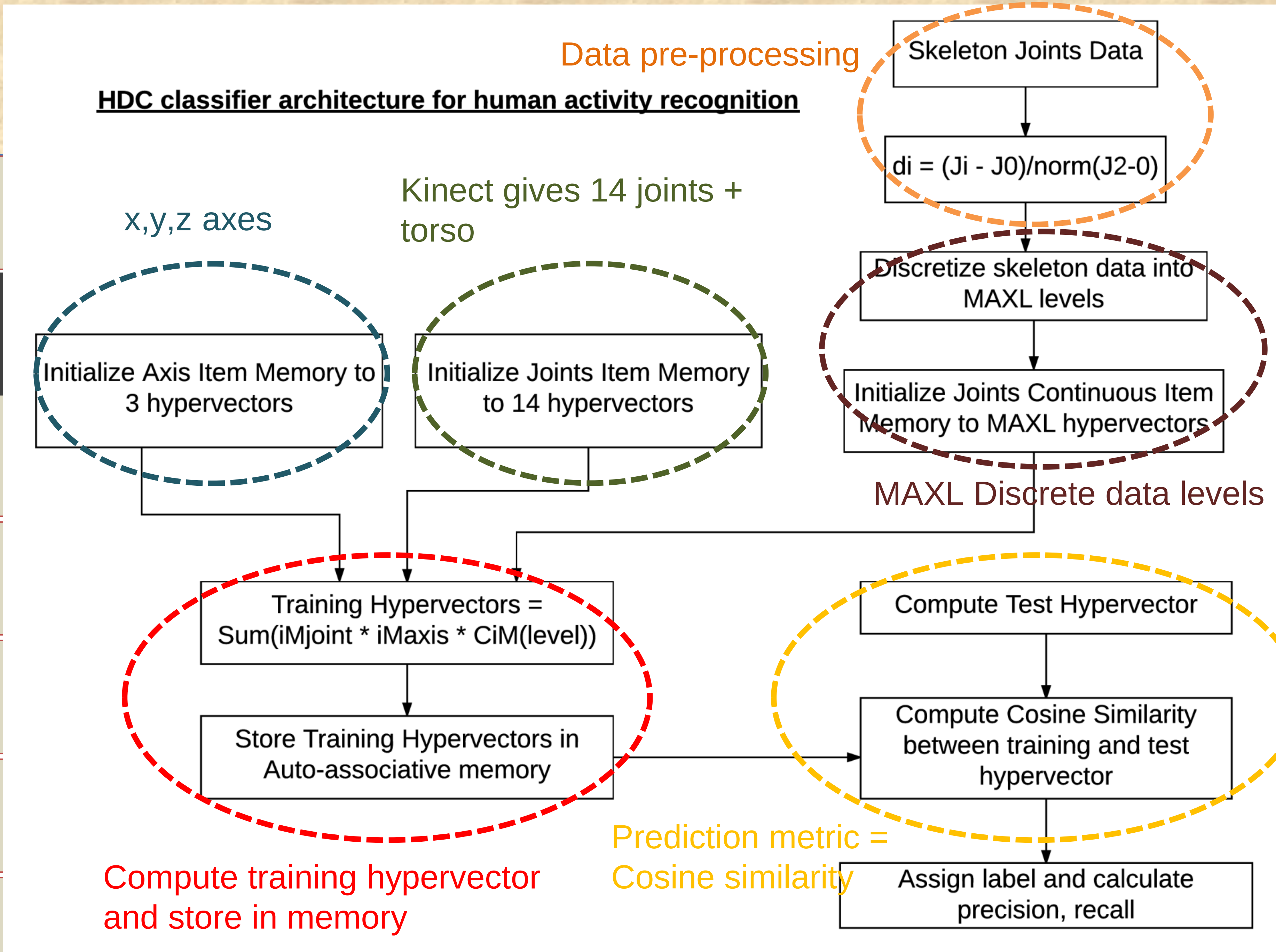
Description:

- 60 RGB-D videos
- 4 subjects
- 5 different environments
- 12 activities

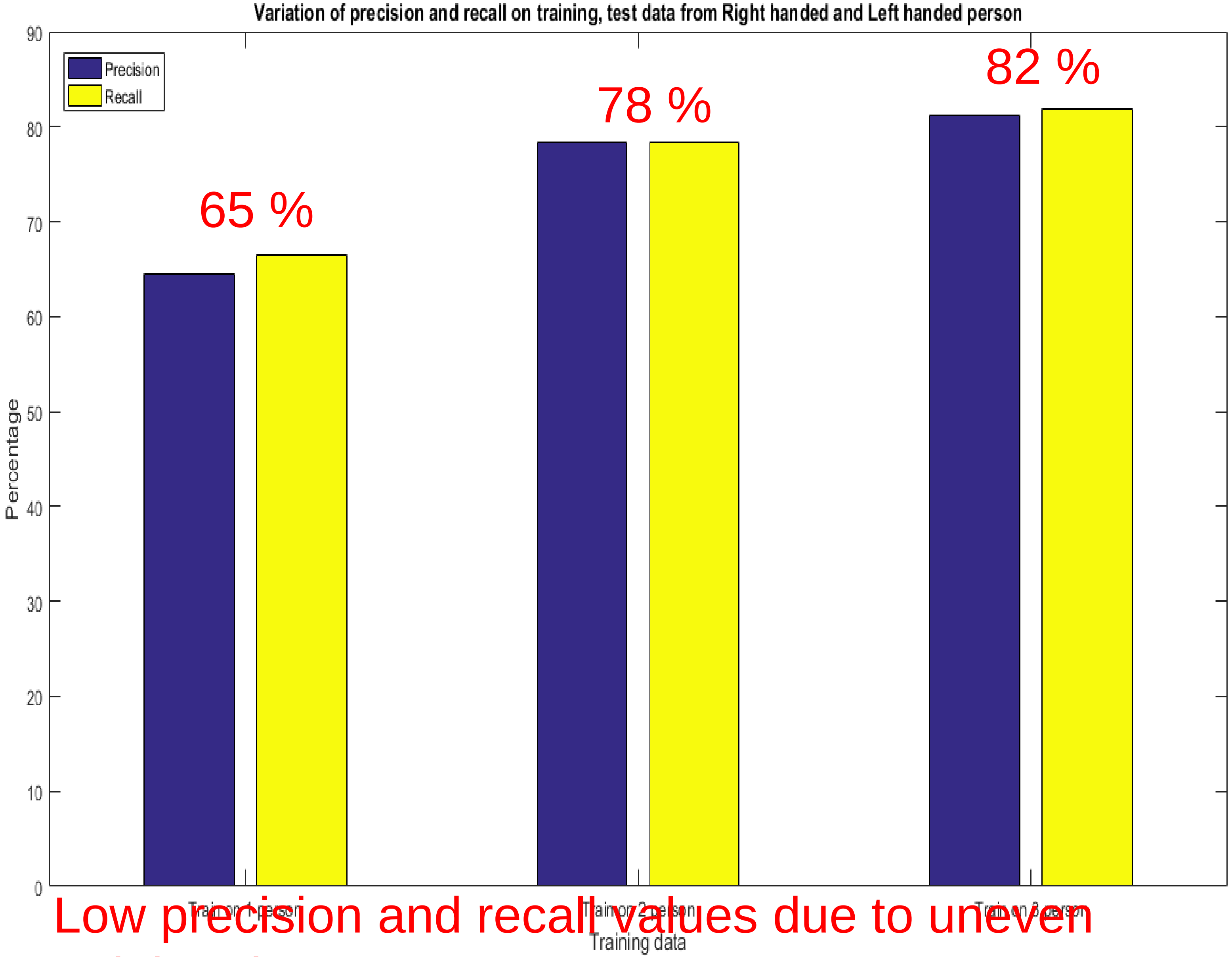
Issues:

3 Right handed person

1 Left handed person


Data pre-processing
Skeleton Joints Data
HDC classifier architecture for human activity recognition
di = (Ji - J0)/norm(J2-0)
Kinect gives 14 joints + torso
x,y,z axes
Discretize skeleton data into MAXL levels
Initialize Axis Item Memory to 3 hypervectors
Initialize Joints Item Memory to 14 hypervectors
Initialize Joints Continuous Item Memory to MAXL hypervectors
MAXL Discrete data levels
Training Hypervectors = Sum(iMjoint * iMaxis * CiM(level))
Compute Test Hypervector
Store Training Hypervectors in Auto-associative memory
Compute Cosine Similarity between training and test hypervector
Prediction metric = Cosine similarity
Assign label and calculate precision, recall
Compute training hypervector and store in memory

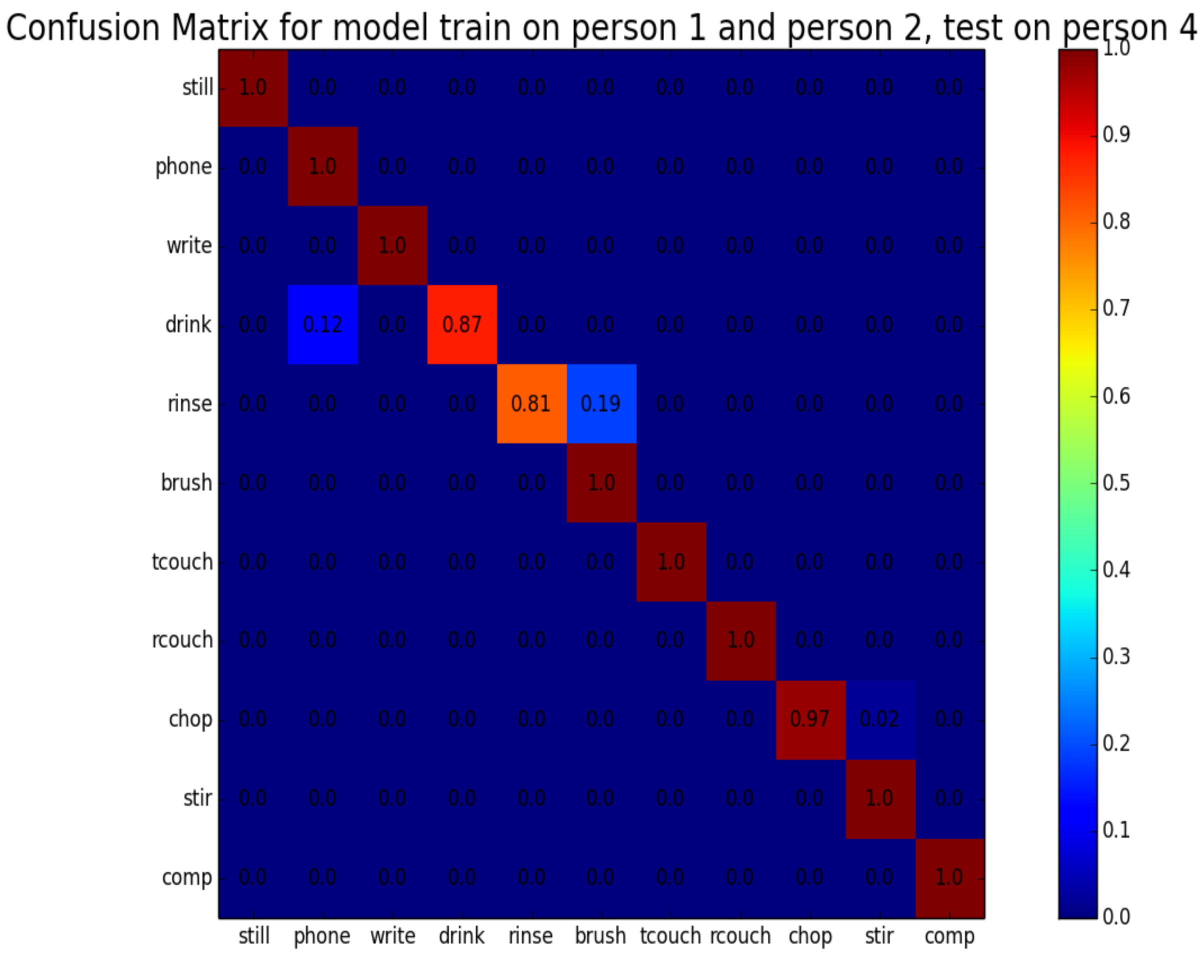
Result: Training on Right and Left



Low precision and recall values due to uneven training data

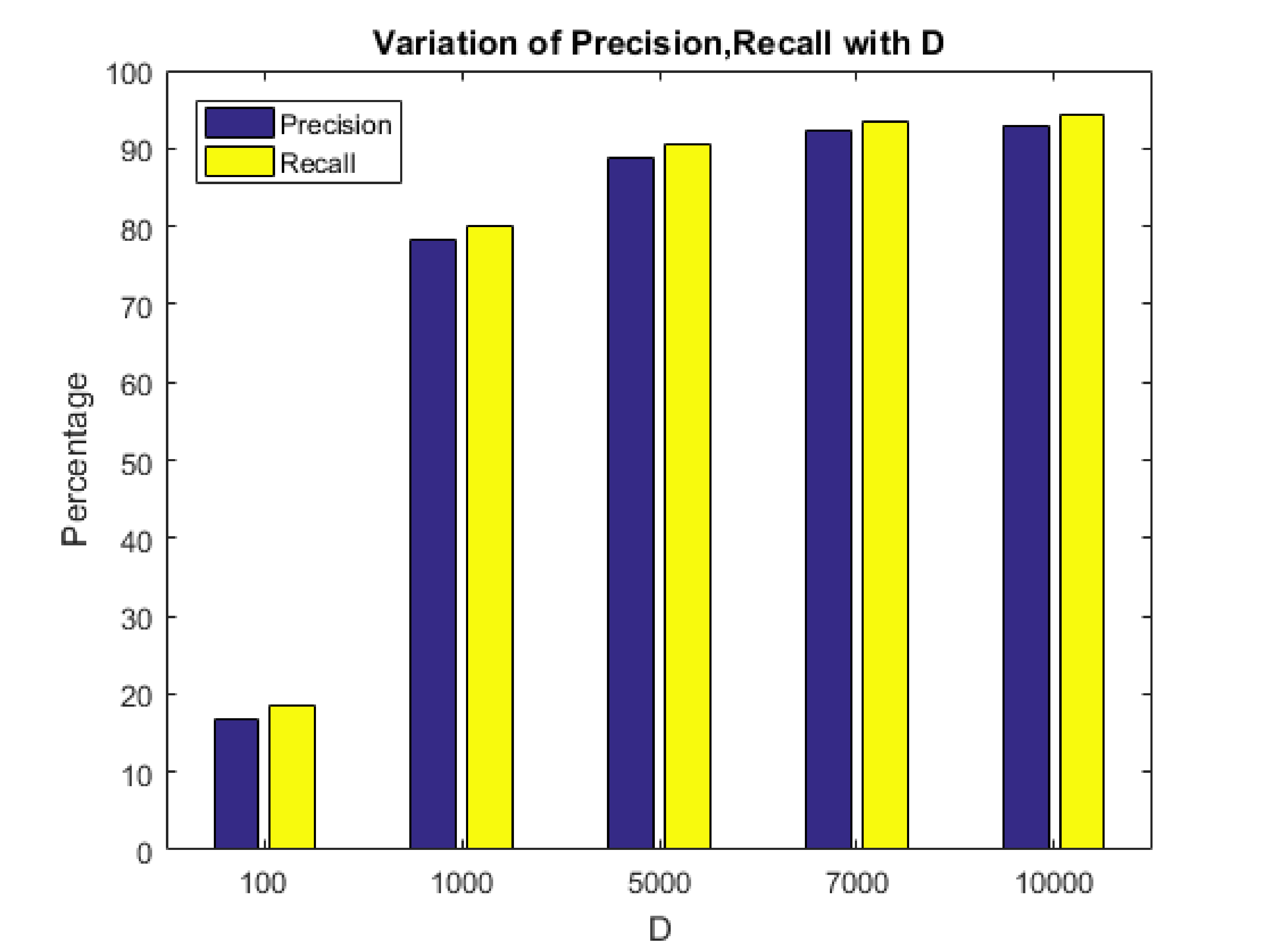
Training and Testing done only on Right handed person

Result: Confusion Matrix

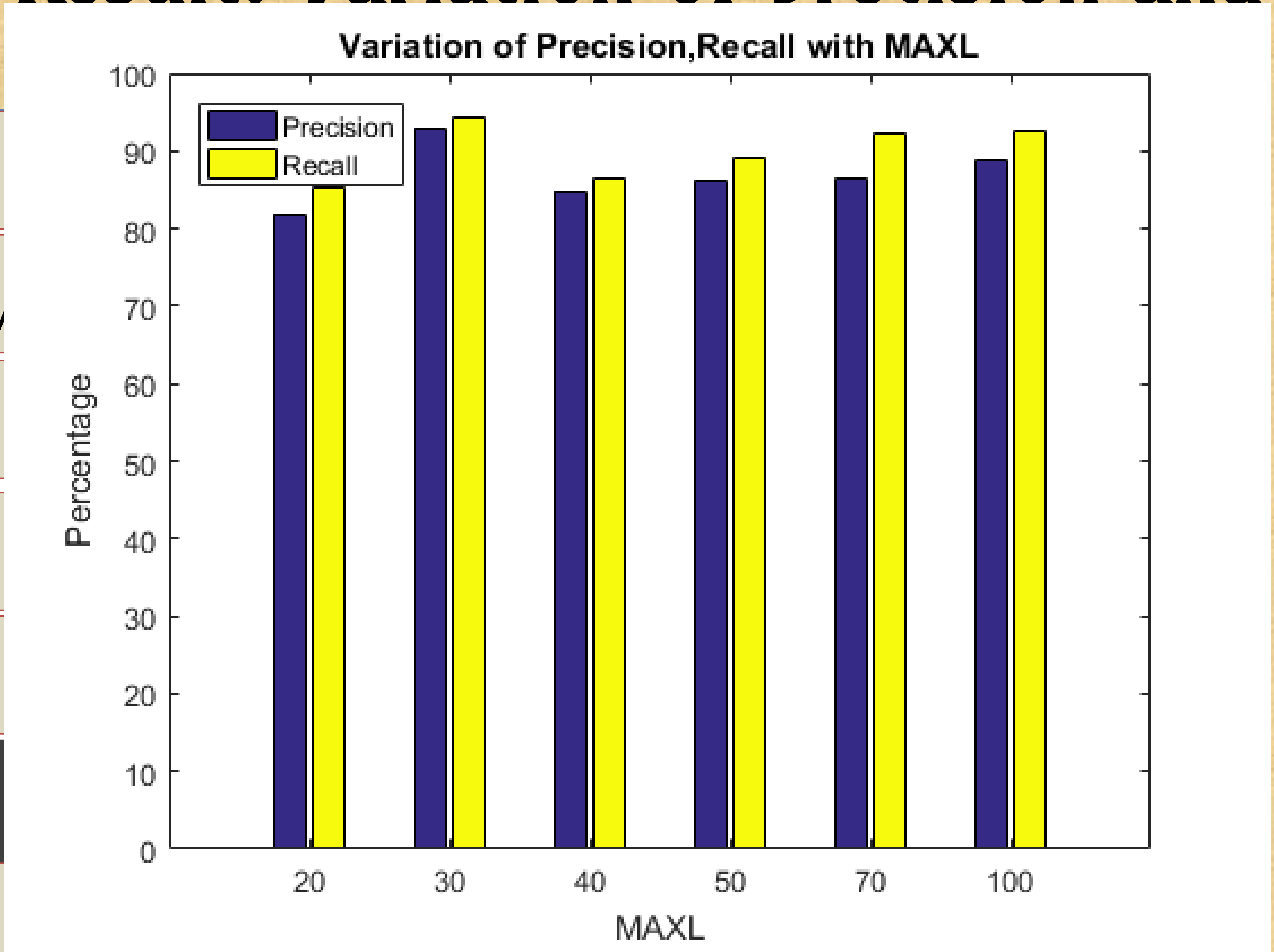


Conclusion

Result: Variation of precision and



Result: Variation of precision and



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	"New Person"	
Algorithm	**Precision (%)**	**Recall (%)**
Sung et al., AAAI PAIR 2011, ICRA 2012. [1,2]	67.9	55.5
Koppula, Gupta, Saxena, IJRR 2012. [3]	80.8	71.4
Zhang, Tian, NWPJ 2012 [4]	86	84
Ni, Moulin, Yan, ECCV 2012 [5]	Accur: 65.32	-
Yang, Tian, JVCIR 2013 [6]	71.9	66.6
Piyathilaka, Kodagoda, ICIEA 2013 [7]	70*	78*
Ni et al., Cybernetics 2013 [8]	75.9	69.5
Gupta, Chia, Rajan, MM 2013 [9]	78.1	75.4
Wang et al., PAMI 2013 [10]	Accur: 74.70	-
Zhu, Chen, Guo, IVC 2014 [16]	93.2	84.6
Faria, Premebida, Nunes, RO-MAN 2014 [17]	91.1	91.9
Shan, Akella, ARSO 2014 [18]	93.8	94.5
Gaglio, Lo Re, Morana, HMS 2014 [19]	77.3	76.7
Parisi, Weber, Wermter, Front. Neurobot. 2015 [20]	91.9	90.2
Cippitelli, CIN 2016 [21]	93.9	93.5

Result 4

Pradhan, HDC 2017: Precision (81.18 %) and Recall (81.88 %)
Or
Pradhan, HDC 2017: Precision (93.04 %) and Recall (94.27 %)
(Only right handed person)

Conclusion

Conclusion

- Precision and Recall can be improved by getting more training data for left handed person
  - Record video from Kinect
  - Mirror data from right handed person

- Spatial and Temporal Hyperdimensional Computing needs to be applied together to improve results

- Use combination of features:

  skeleton + joint orientation + HOG RGB + HOG depth