Subtle Expression Recognition using Motion Magnification

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Motivation

Facial Expression Recognition
- active area of research
- has wide applications
- conveys the emotional state of an individual
- used to detect lies and in various fields of psychology
- challenging task for machines

Why Motion Magnification?
- Inability to identify subtle facial expressions using current techniques
- Motion Magnification will help in detecting subtle facial expressions

Related Work Done

Subtle Facial Expression
- Sungsoo Park, Daijin Kim, Subtle Facial Expression Recognition using Motion Magnification [2009]

Motion Magnification
- Michael Rubinstein, Eugene Shih et. al., Eulerian Video Magnification for Revealing Subtle Changes in the World, CSAIL, Quanta Research Cambridge, Inc., 2012
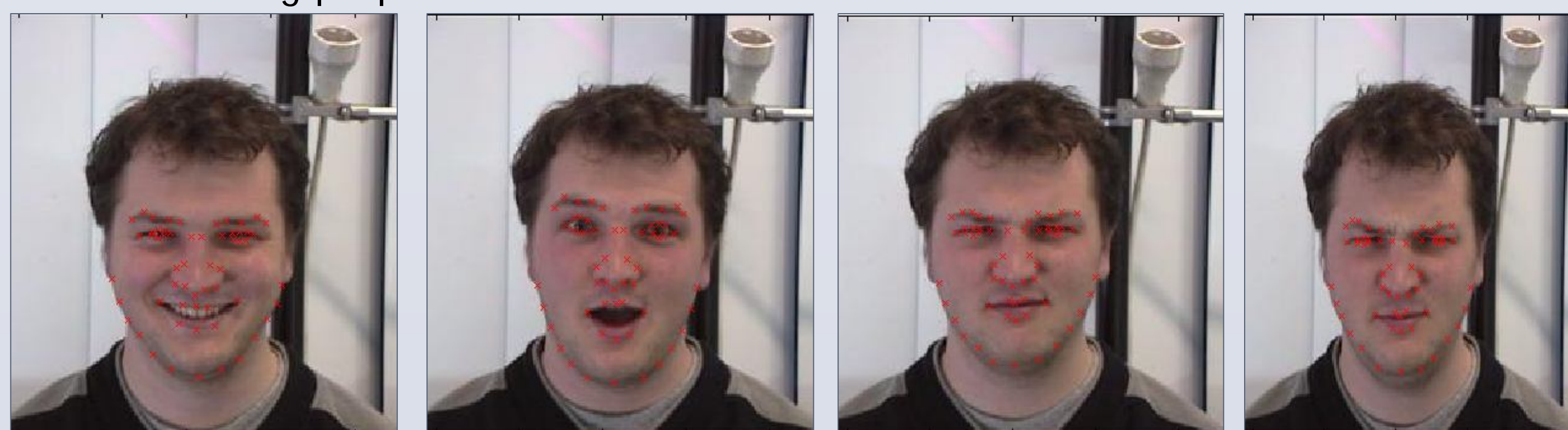
AAM Fitting
- T.F. Cootes, G.J. Edwards, C.J. Taylor, Active Appearance Models [1998]
- Iain Matthews, Simon Baker, **Active Appearance Models Revisited** [2002]

## Our Approach

- Training Data
  - Our training data consists of exaggerated emotions along with labels of emotions.
  - These images are manually marked with 58 landmarks (feature points) for training purposes.
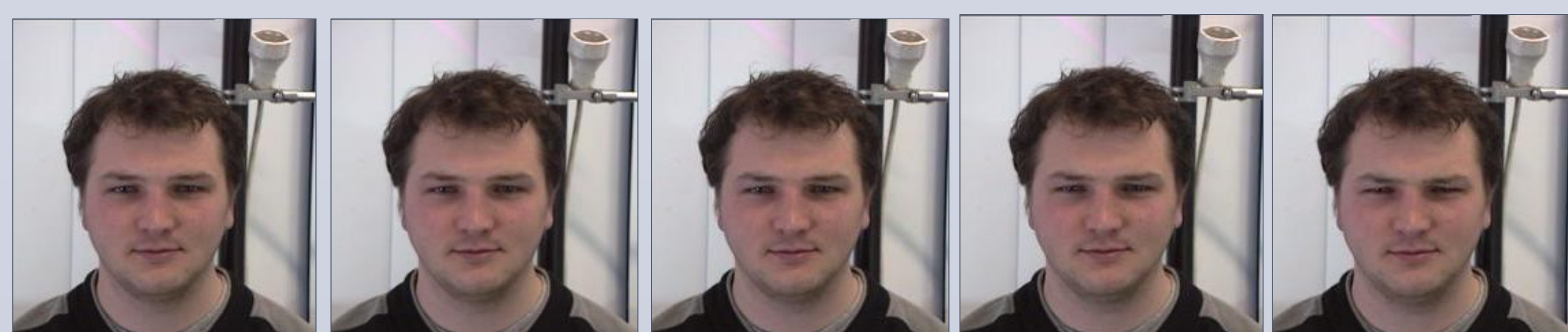

Images from Source[5]

- Testing Data
  - Our testing data consists of sequences of images starting from neutral expression which gradually changes to a subtle expression.
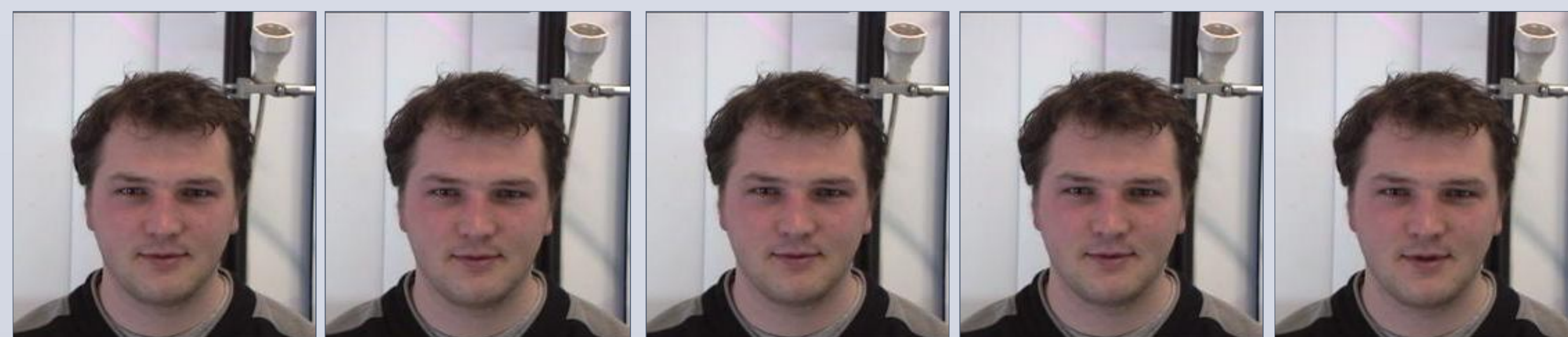
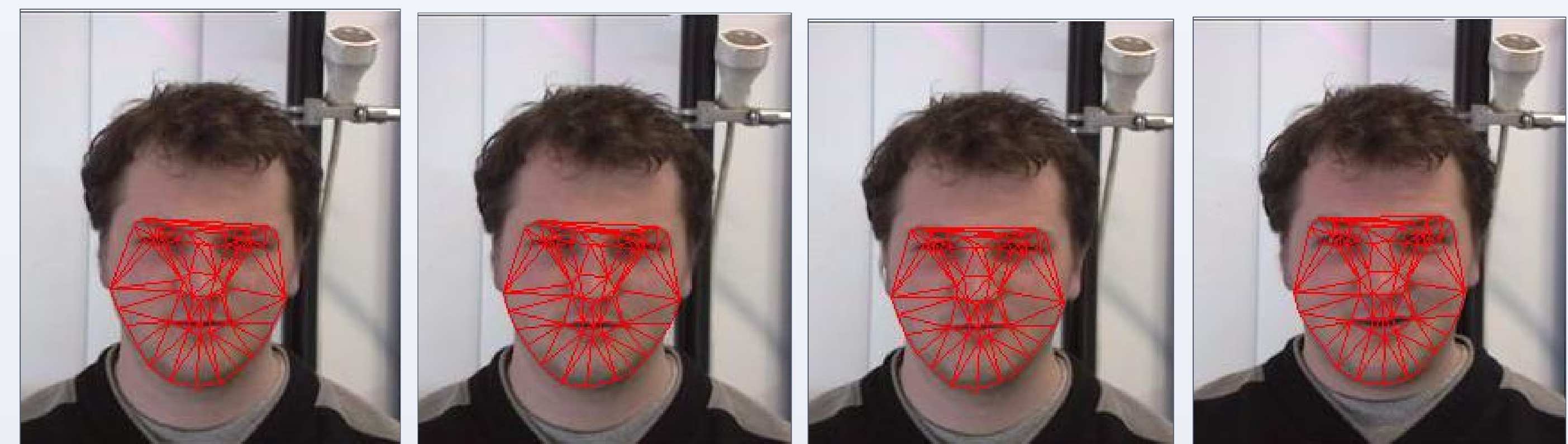Subtle Surprise   Images from Source[5]

Subtle Anger   Images from Source[5]

- Active Appearance Model (AAM) Fitting on Test Data
  - We use the AAM fitting algorithm to find the shape vector (feature points) of all the images in the test sequences.
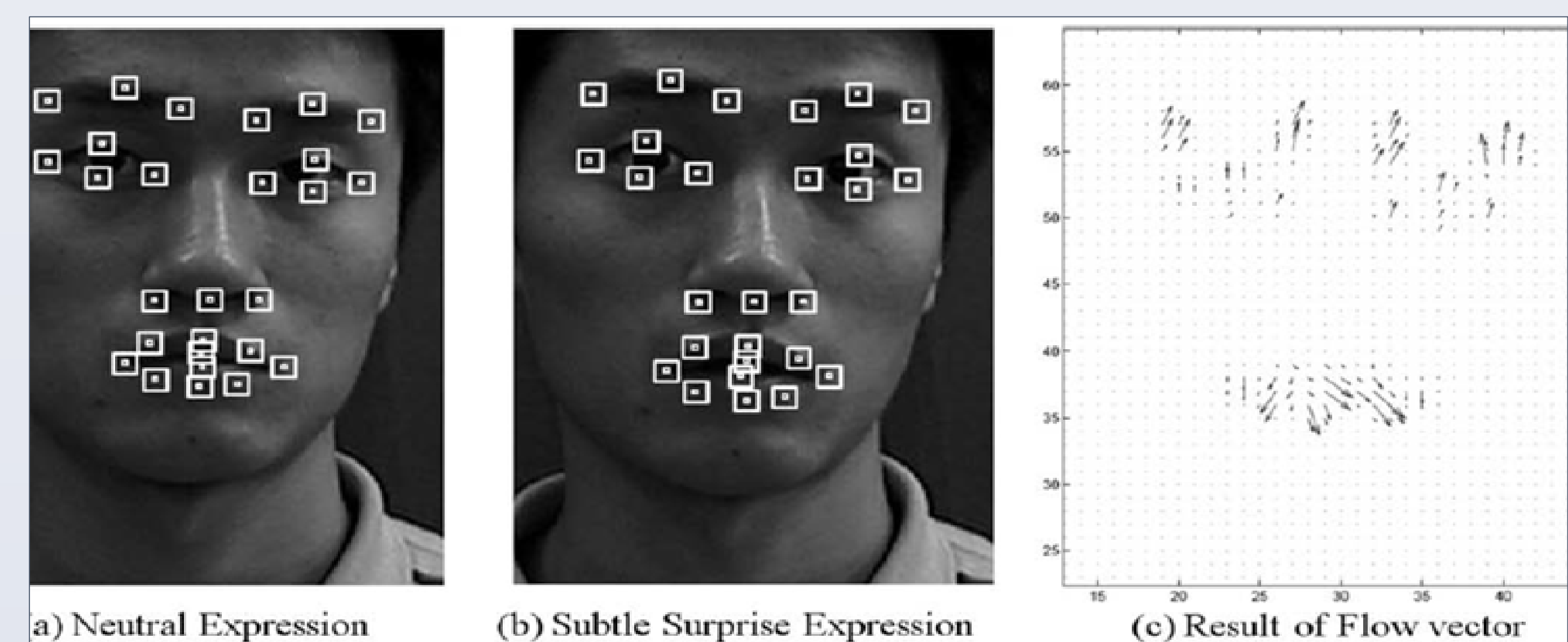

Images from Source[5]

- Motion Magnification
  - We magnify the motion depicted in the sequence of the image using the following equation:
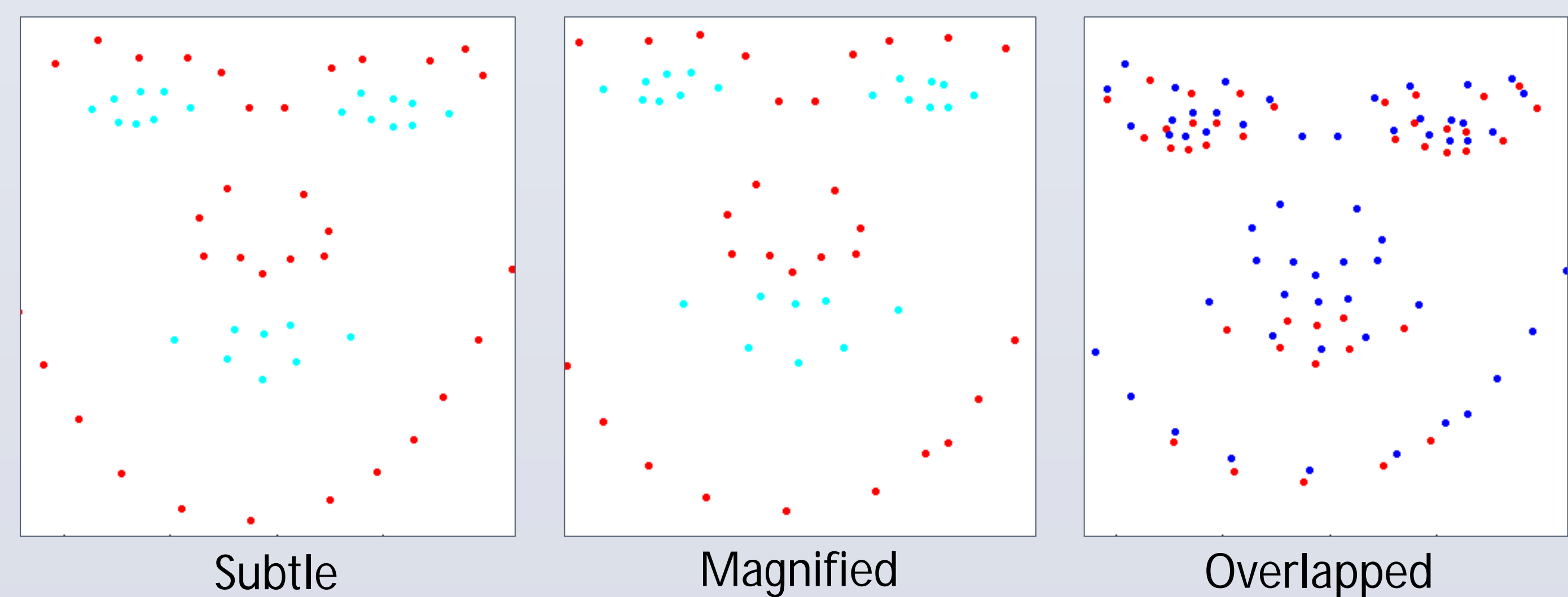
$$s_{mag}(t+1) = s(t) + \beta*[s(t+1) - s(t)]$$ (ß: Magnification Factor)

Here s(t) is the shape vector(containing (x,y) coordinates of the landmarks at time 't')

a) Neutral Expression   (b) Subtle Surprise Expression   (c) Result of Flow vector

Images from Source[1]

Magnification of Subtle Expression:

Subtle   Magnified   Overlapped

Results

Classified Emotions
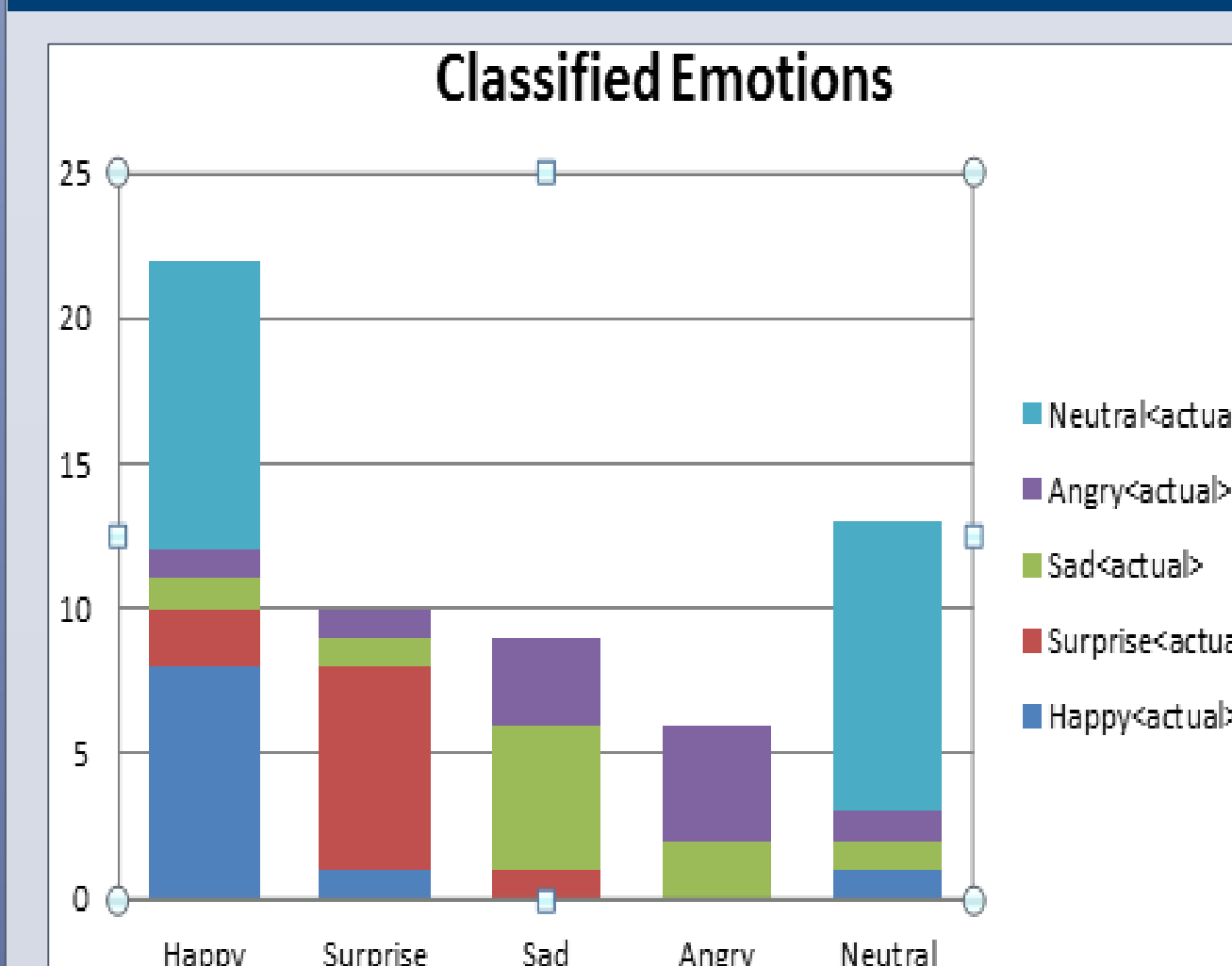
Classified Emotion	Angry	0	0	0	2	4
	Sad	0	0	1	5	3
	Surprise	0	1	7	1	1
	Happy	0	8	2	1	1
	Neutral	10	1	0	1	1
		Neutral	Happy	Surprise	Sad	Angry
		Known Emotions				

We have used a test set of 50 sequences. 10 for each class

References

[1] Sungsoo Park, Daijin Kim, **Subtle Facial Expression Recognition using Motion Magnification** [2009]

[2] T.F. Cootes, G.J. Edwards, C.J. Taylor, **Active Appearance Models** [1998]

[3] Iain Matthews, Simon Baker, **Active Appearance Models Revisited** [2002]

[4] Generated using Code for **ICAAM** by Luca Vezzaro. We used this code for AAM fitting.

[5] **F**acial **E**xpressions and **E**motion **D**atabase, **FEED**, **Interactive Systems Group**. This is also our DATASET for the project.