Emotion Recognition Through Facial Expressions

Xavier Walcome

Division of Science and Mathematics
University of Minnesota, Morris
Morris, Minnesota, USA

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Why does this matter?

- Emotion recognition has a broad amount of applications
  - Recognizing depression
  - Assisting those who cannot recognize emotion naturally
  - User feedback
- Implementing a system is taxing on those implementing it
- It is still very far from perfection

emotiW Challenge

Annual challenge taking place during the International Conference on Multimodal Interaction.

Give videos to entrants who implement a system to predict which of 7 emotions depicted in the video.

Emotions

- Happiness
- Anger
- Sadness
- Surprise
- Fear
- Disgust
- Neutral

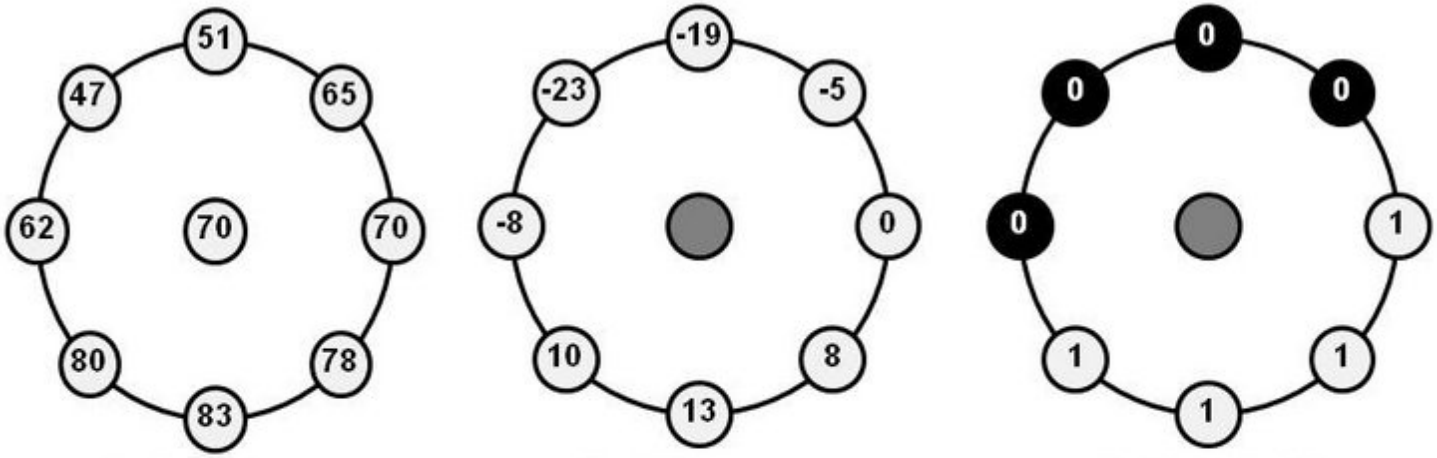
Outline

Outline

Local Binary Patterns

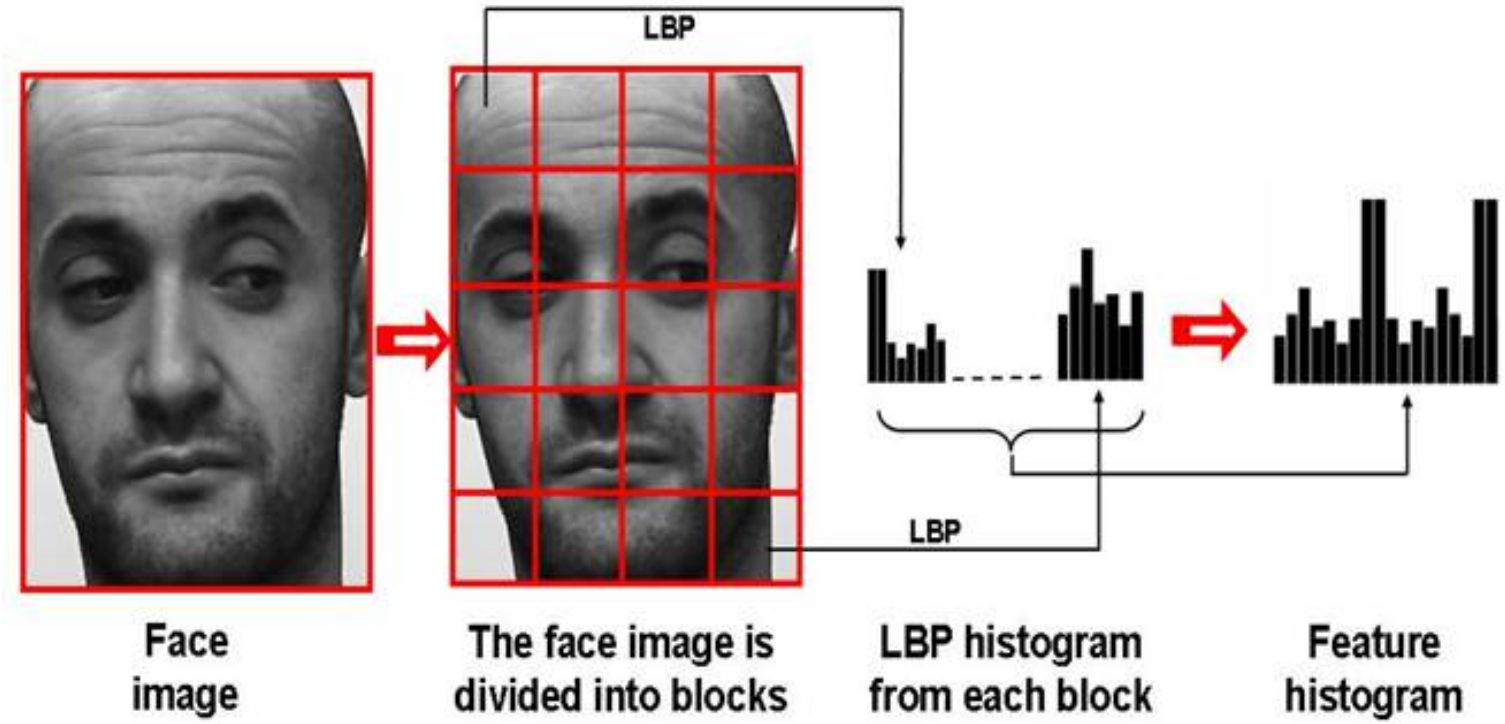
- Compares the gray scale value of pixels to surrounding points
- Recognizes contours and other features in an image
- The LBP operator takes in a center pixel, radius, and amount of sampling points

Local Binary Patterns



- Choose the radius and sample points
- Set each point to 0 or 1 based on the difference of the points gray scale value and the center gray scale value
- Convert these values to a binary value

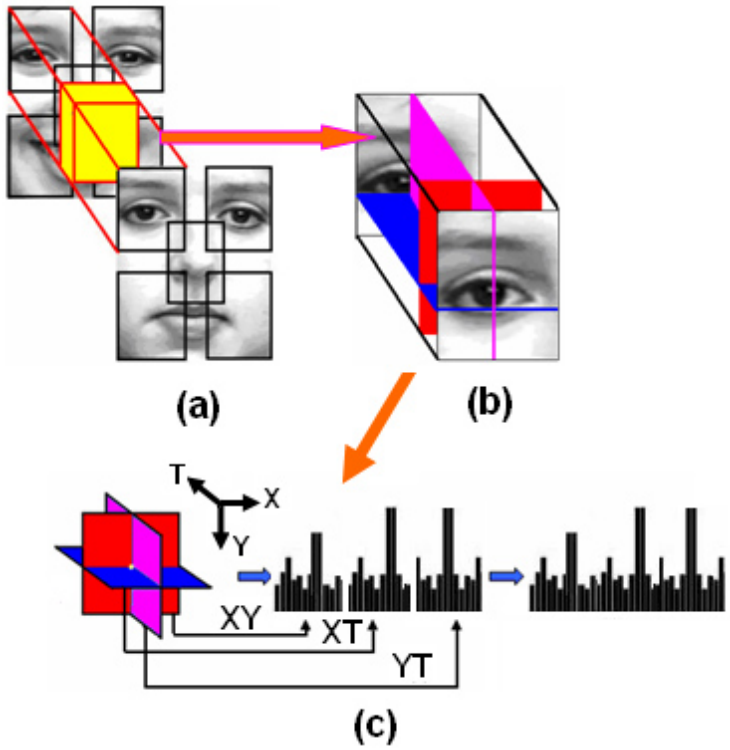
LBP cont.



- The image is split into a grid
- LBP is performed on each of the sections of the grid
- The LBP codes are then stored into a histogram

Local Binary Patterns from Three Orthogonal Planes

- The set of frames (video) is split into a grid
- Each section is split into three orthogonal planes
  - XY
  - XT
  - YT
- LBP operator is performed on all three planes of each section of the grid
- The histograms from each plane are then concatenated together



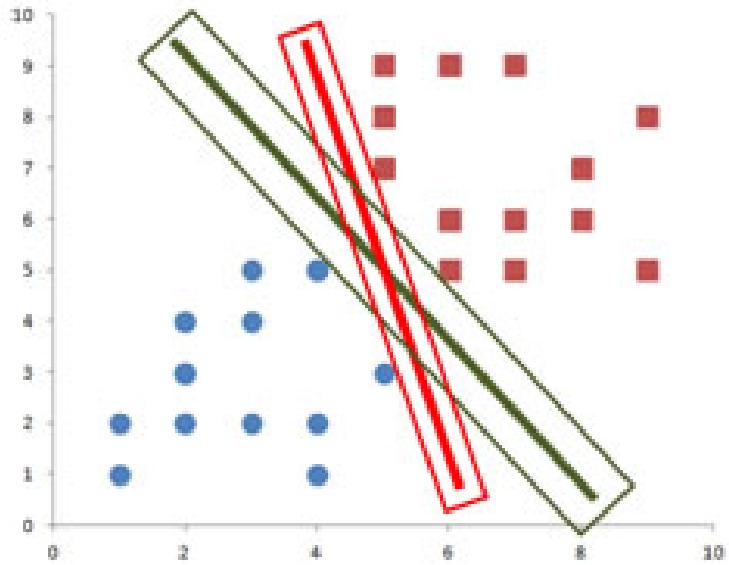
Outline

Machine Learning Introduction

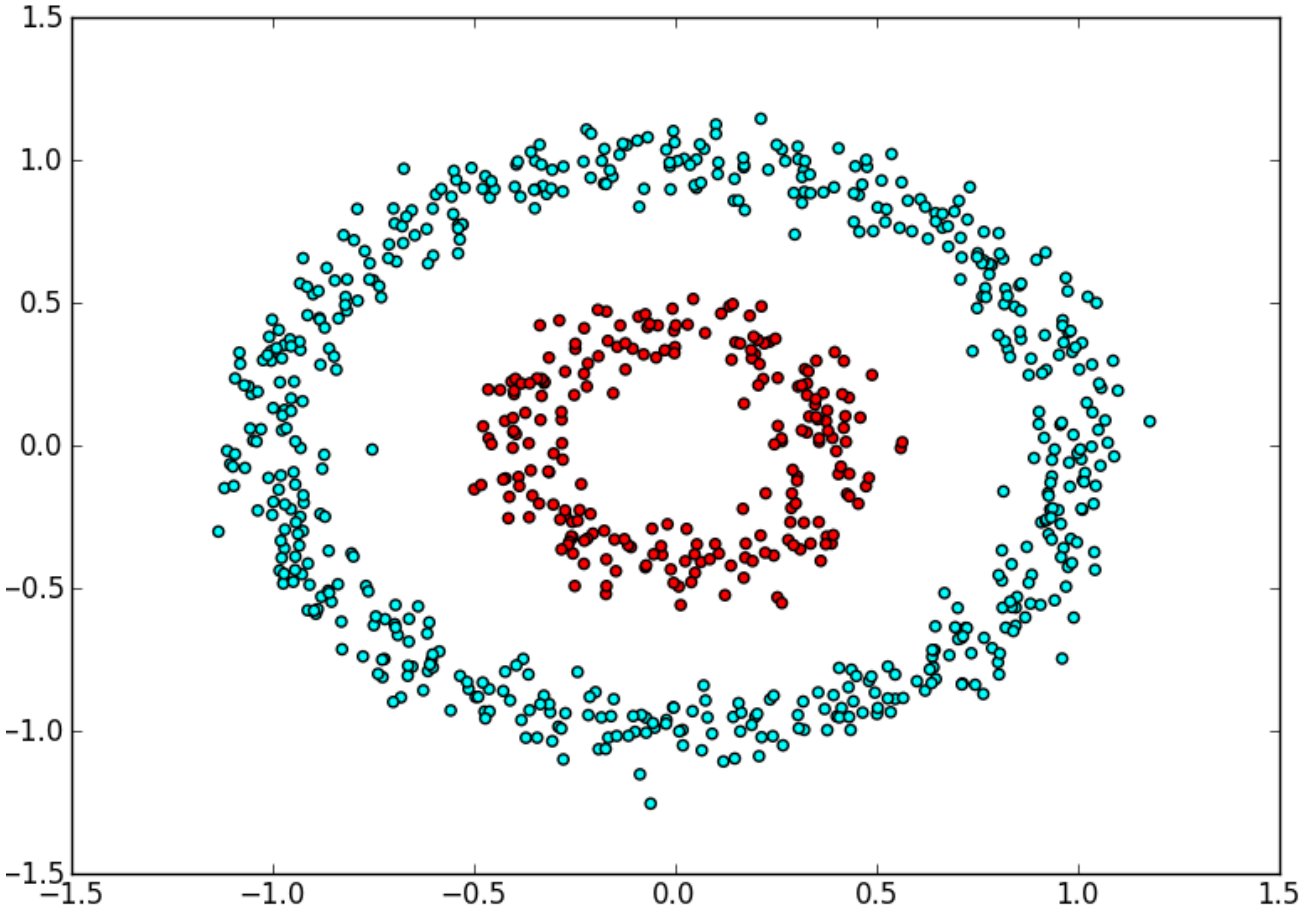
- Algorithms that can learn from data and make predictions on new data
- A model is created for a certain type of data
- Training data is given to the model
- The model predicts the category of new data

Support Vector Machines

- One Versus One
  - Which emotion is the vector?
- One Versus Many
  - Is the vector one emotion or is it not?
- The data is compared on a 2D plane for both of these
- The ideal decision boundary has an optimal margin between the two categories



Non-linearly separable data



https://youtu.be/3liCbRZPrZA?t=9

Lifting data

- Data can be lifted into a 3D plane using a kernel function
- Allows data to be looked at in a way where a hyperplane can separate the different categories

Outline

Studies

- Ringeval et. al.
  - LBP-TOP and SVM
  - Tracking lip activity
  - One versus one and one versus many
- Krishna et. al.
  - Gabor Filtering
  - Optic flow
- Sun et. al.
  - LBP TOP and LPQ TOP
  - SVM

Table: Results of Studies

Paper	Accuracy	Comments
Ringeval et. al.	36.13%	EmotiW 2014
Krishna et. al.	20.51%	Independent
Sun et. al. LBP-TOP	36.12%	EmotiW 2014
Sun et. al. LPQ-TOP	19.68%	EmotiW 2014

Outline

Conclusion

- Creating a universal database of data
- More use of lip activity
- Using more advanced machine learning

References

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IEEE PAMI, June 2007, Volume 29.6 pg. 915-928.

A. Ben-Hur, J. Weston
A User's Guide to Support Vector Machines

F. Ringeval, S. Amiriparian, F. Eyben, K. Scherer, B. Schuller
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ICMI '14, pg. 473-480

References


T. Krishna, A. Rai, S. Bansal, S. Khandelwal, S. Gupta, D. Goyal
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ICMI '13, pg. 557-564


B. Sun, L. Li, T. Zuo, Y. Chen, G. Zhou, X. Wu
Combining Multimodal Features with Hierarchical Classifier Fusion for Emotion Recognition in the Wild
ICMI '14, pg. 481-486

Questions?

walco005@morris.umn.edu