



Emotion-Aware Machines

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What does it mean for a machine to be emotion aware?

- Detect our emotions



- Express emotions



What does it mean for a machine to be emotion aware? (Natural language focus)

- Detect our emotions in what we speak/write



- Express emotions through the text/speech they generate



Sentiment Analysis

- Is a given piece of text **positive, negative, or neutral**?
 - The text may be a sentence, a tweet, an SMS message, a customer review, a document, and so on.

Emotion Analysis

- What emotion is being expressed in a given piece of text?
 - Example emotions: **joy, sadness, fear, anger, guilt, pride, optimism, frustration,...**

Applications of Automatically Detecting Sentiment and Emotions

- Computer games and animation



Applications of Automatically Detecting Sentiment and Emotions

- Computer games and animation
- Detecting cyber-bullying, depression



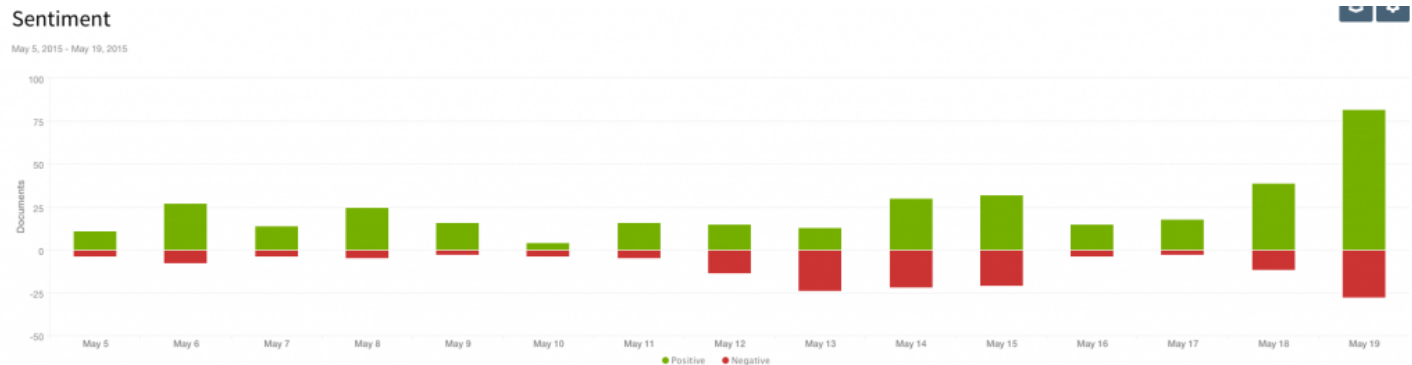
Applications of Automatically Detecting Sentiment and Emotions

- Computer games and animation
- Detecting depression, cyber-bullying
- Tutoring systems, writing assistants



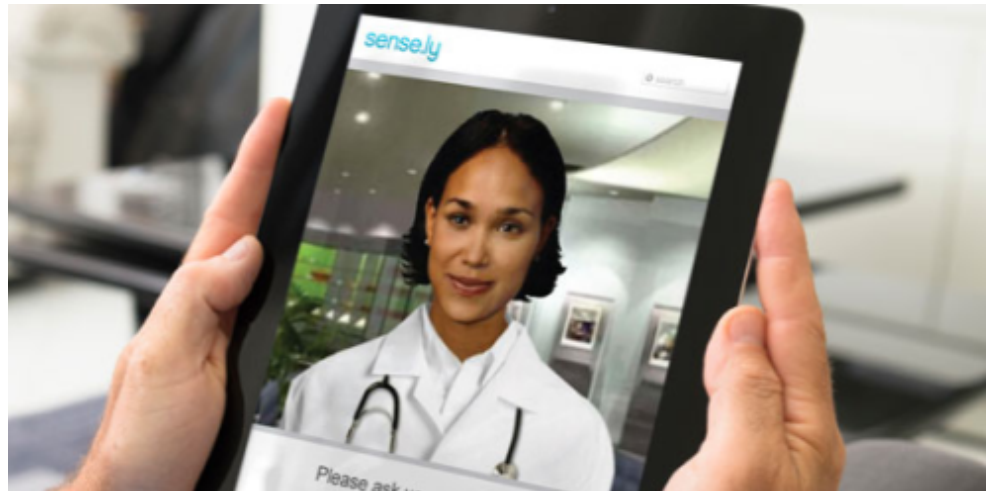
Applications of Automatically Detecting Sentiment and Emotions

- Computer games and animation
- Detecting depression, cyber-bullying
- Tutoring systems, writing assistants
- Tracking sentiment towards products, events, people



Applications of Automatically Detecting Sentiment and Emotions

- Computer games and animation
- Detecting depression, cyber-bullying
- Tutoring systems, writing assistants
- Tracking sentiment towards products, events, people
- Physiotherapy robots, virtual nurses



DETECTING SHAPES OF STORIES

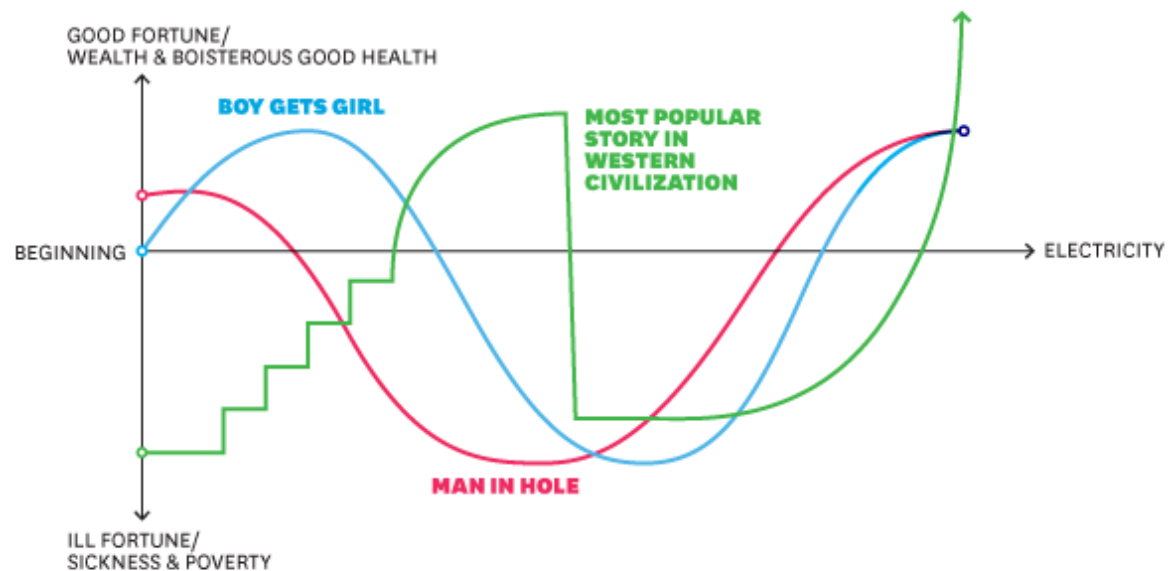


Tracking Emotions in Stories

- Can we automatically track the emotions of characters?
- Can we track the change in distribution of emotion words?
- Are there some canonical shapes common to most stories?

SIMPLE SHAPES OF STORIES

As told by Kurt Vonnegut.



SOURCE DAVID YANG, VISUAL.LY

HBR.ORG



Where do we start?

Making machines *understand* the meaning of sentences is a difficult problem.

Word-Emotion Associations

Words have associations with emotions:

- **attack** and **public speaking** typically associated with **fear**
- **yummy** and **vacation** typically associated with **joy**
- **loss** and **crying** typically associated with **sadness**
- **result** and **wait** typically associated **anticipation**

Goal: Capture word-emotion associations.

Emotions

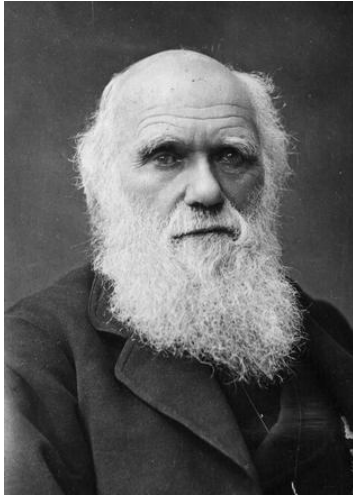
- Anger
- Disgust/Hate
- Fear
- Joy
- Love
- Sadness
- Surprise
- ...

How many emotions are there?

Emotions



Anybody know this cool guy?



Charles Darwin

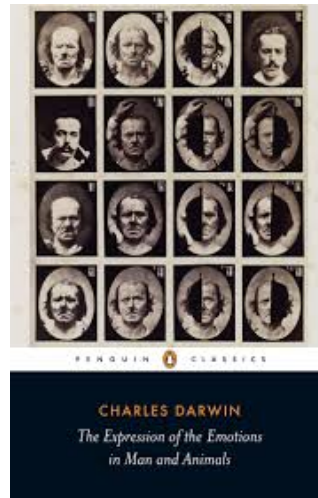
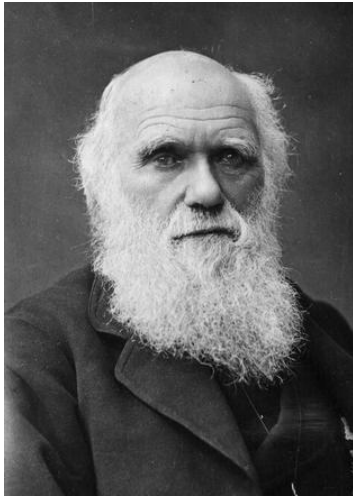
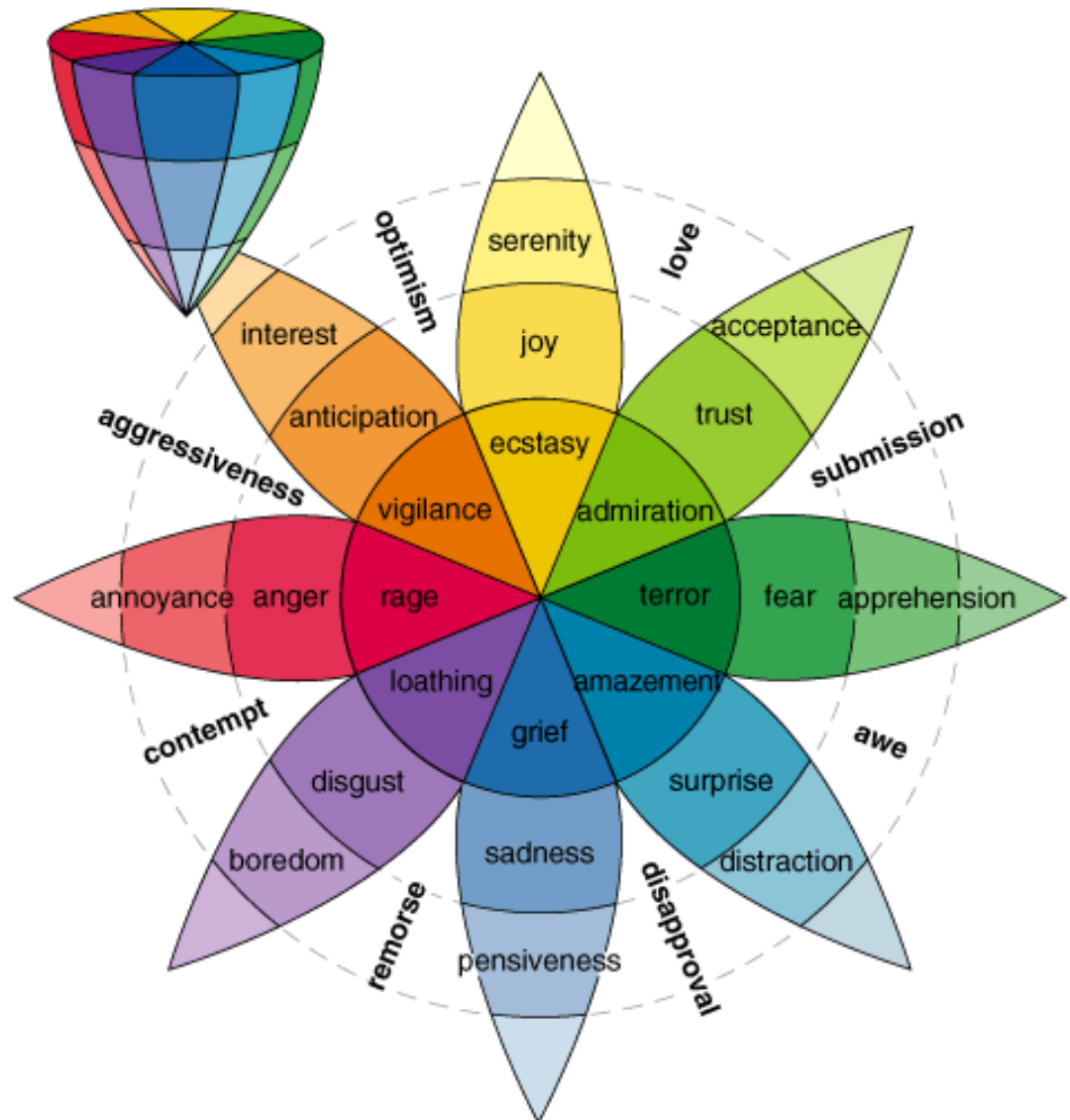


FIG. 20.—Terror,
from a photograph by Dr. Duchenne.

- published *The Expression of the Emotions in Man and Animals* in 1872
- seeks to trace the animal origins of human characteristics
 - pursing of the lips in concentration
 - tightening of the muscles around the eyes in anger
- claimed that certain facial expressions are universal
 - these facial expressions are associated with emotions

Plutchik, 1980: Eight Basic Emotions

- Anger
- Anticipation
- Disgust
- Fear
- Joy
- Sadness
- Surprise
- Trust



Word-Emotion Associations

Goal: Capture word-emotion associations for the eight Plutchik emotions.

Two ways:

- manually
- automatically

Crowdsourcing

How a large number of people can solve complex tasks that are currently beyond the capabilities of artificial intelligence algorithms.

- Break up a task into hundreds of thousands of small independent units
- Post the units up on the internet and invite people to solve them

Emotion Lexicon



Peter Turney, AI2

- NRC Emotion Lexicon
 - emotion and sentiment associations for 14,200 words

Available at: www.saifmohammad.com

Paper:

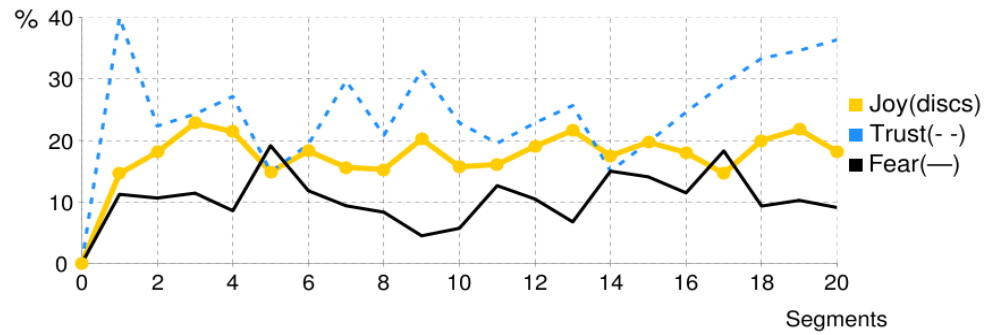
[Crowdsourcing a Word-Emotion Association Lexicon](#), Saif Mohammad and Peter Turney, *Computational Intelligence*, 29 (3), pages 436-465, 2013.



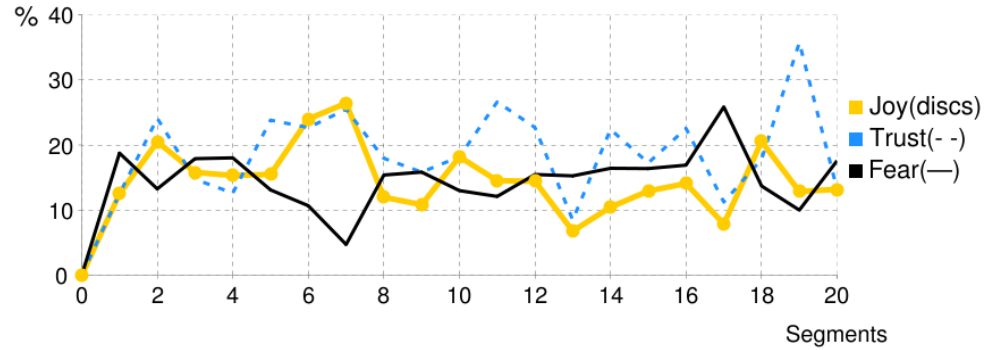
Tony Yang, Simon Fraser University

Visualizing Emotions in Text

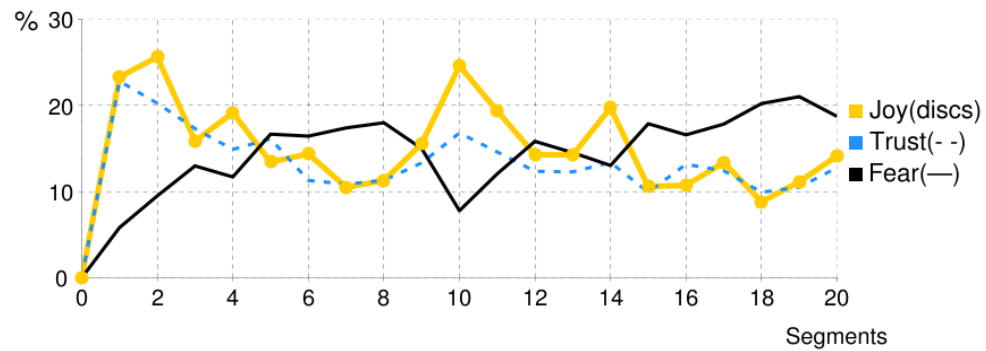
As You Like It

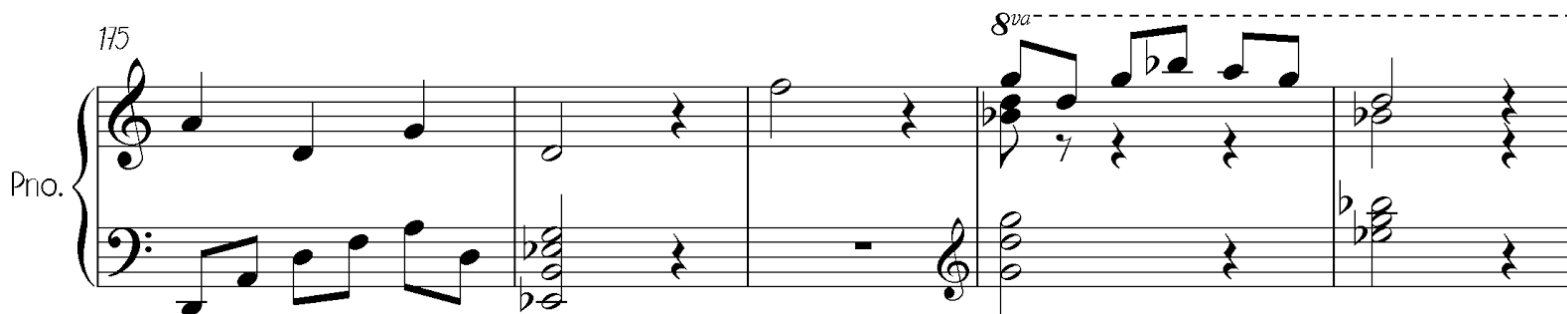
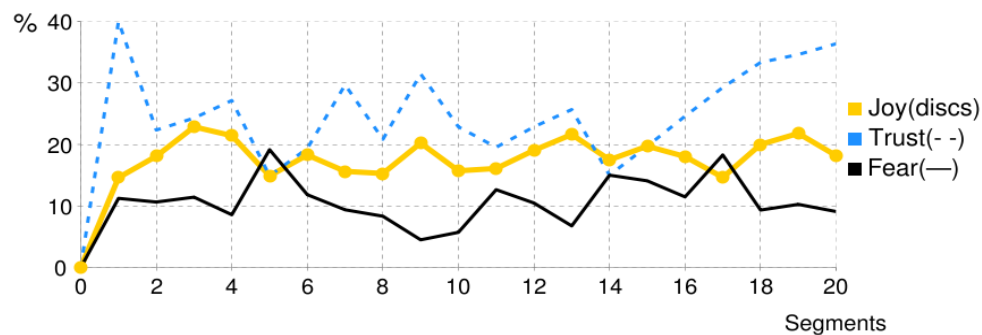
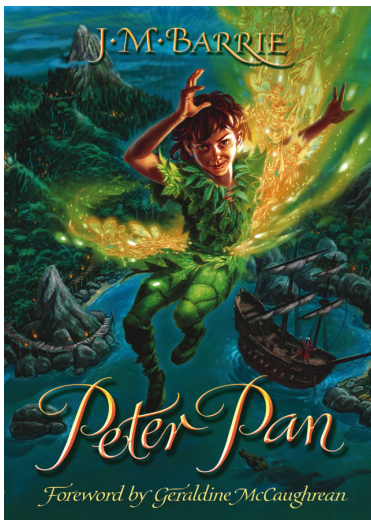


Hamlet



Frankenstein





A method to generate music from literature.

- music that captures the change in the distribution of emotion words.



Hannah Davis
Artist/Programmer

Generating Music from Text

Paper:

- **Generating Music from Literature.** Hannah Davis and Saif M. Mohammad, In Proceedings of the EACL Workshop on Computational Linguistics for Literature, April 2014, Gothenburg, Sweden.

Challenges

- Not changing existing music -- generating novel pieces
- Paralysis of choice
- Has to sound good



Music-Emotion Associations

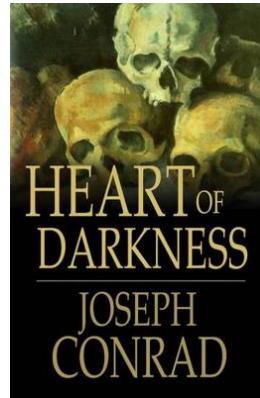
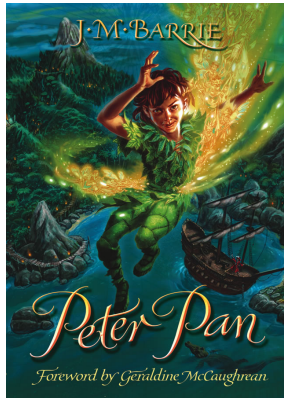
- Major and Minor Keys
 - major keys: happiness
 - minor keys: sadness
- Tempo
 - fast tempo: happiness or excitement
- Melody
 - a sequence of consonant notes: joy and calm
 - a sequence of dissonant notes: excitement, anger, or unpleasantness

Hunter et al., 2010, Hunter et al., 2008, Ali and Peynirciolu, 2010,
Gabrielsson and Lindstrom, 2001, Webster and Weir, 2005

Pieces

Three simultaneous piano melodies pertaining to the dominant emotions.

Examples



TransProse: www.musicfromtext.com

Music played 300,000 times since website launched in April 2014.

TransProse Music Played by an Orchestra, at the Louvre Museum, Paris



A symphony orchestra performs under the glass of the Louvre museum in Paris on Sept. 20. Accenture Strategy has created a symphonic experience enabled by human insight and artificial intelligence technology. (Michel Euler/AP)



Natural Language Processing
Artificial Intelligence
Machine Learning
Computer Science
Mathematics
Linguistics
Psychology
Cognitive Science