

Affective Computing

ATCM State-of-the-Art
Theoretical Presentation

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History

- “Emotion” was been studied by psychologists since the 19 century (James (1884))
- Artificial Intelligence area:
 - ▶ came with the idea of the possibility to understand people and bring emotions to the systems
 - ▶ computer programs designed to recognise what users are experiencing



Affective Computing

- “Affective Computing” was established in 1997 by Rosalind Picard (Picard (1997))
- Since then...
 - several branches/modifications were created
- Interdisciplinary field spanning:
 - ▶ computer sciences
 - ▶ psychology
 - ▶ cognitive science
 - ▶ among others



Affective Computing

- **Computer science** believes that the human intelligence can be described to the point that it can be simulated by a machine
- **Aims to** design AI programs capable of:
 - ▶ recognise
 - ▶ respond
 - ▶ interpret and simulate human emotional states
 - ▶ **ultimate goal is simulating empathy**
- Although **machines do not feel emotion**, they must be able to express and interpret emotions to interact better with us



Emotion Theories

- Emotions in humans are complex and must be studied interdisciplinary
- Word “emotion” has no unique and clear meaning
- Emotions can be distinguished as:
 - ▶ primary
 - ▶ secondary
 - ▶ mixed



Emotion Theories

Primary, Secondary and Mixed Emotions

- Primary
 - ▶ involves physiological reactions, e.g., related to fleeing, attacking, freezing, etc.
 - ▶ sensors measuring physiological changes, e.g., facial expression and posture, can detect primary emotions
- Secondary
 - ▶ semantically rich affective states generated by cognitive processes
 - ▶ reactions from primary emotion
 - ★ for example “feel” – “a flush of embarrassment” and “growing tension”
- Mixed
 - ▶ e.g., jealousy and guilt at feeling jealous – coexisting emotions



Affective Linguistic

- “I just had a car accident”
 - ▶ does not contain any emotional keyword, but contains affective information
 - ▶ a person that just had a car accident is certainly not happy, and most probably sad or even frightened
 - ▶ emotional content in text need to be extracted by using common-sense knowledge



Affective Linguistic

- It has been created methods to estimate **positive** or **negative** sentiment
- State of the art in sentiment has been studied at three different levels:
 - ▶ Turney (2002) - words
 - ▶ Kim and Hovy (2006) - sentences
 - ▶ Hu and Liu (2004) - documents



Affective Artificial Agents

- The **role of emotions in cognitive processes is essential** for planning or decision-making
- Question is:
 - ▶ “Why do not agents take similar advantages from emotion?”
- Affective artificial emotions field is in an initial phase...
- The existing approaches can be organised into three main groups:
 - ▶ systems that **recognise** emotions
 - ▶ systems that **express** emotions
 - ▶ systems that **generate** emotions



Affective Recommender Systems

Detecting Affective States

- Affective states of end users (in any stage of the interaction chain) can be detected in two ways:
 - ▶ explicitly
 - ★ it is an **intrusive process** that breaks the interaction process
 - ★ more accurate
 - ▶ implicitly
 - ★ well suited for user interaction purposes since the **user is not conscious of it**
 - ★ less accurate



Affective Recommender Systems

Affective User Modelling

- The most relevant information for the user may not only depend on his preferences, but also in his context
- The very same content can be relevant to a user in a particular context, and completely irrelevant in a different one
- It is accepted that context can change the state for a item be recommended, i.e., user mood can change and that is why it is a context of the user



Affective Recommender Systems

Affective User Modelling

- Some authors suggest to use affective labels for tagging the content by using unobtrusive emotion detection techniques (Vinciarelli et al. (2009))
- However, RS based on affective user modelling are still in a early stage



Japanese develop 'female' android

Loading ...



Concluding Remarks

- AC is considered one fascinating new area of research emerging in computer science
- AC is concerned with the theory and construction of machines which can detect, respond to, and simulate human emotional states
- Requires a broad multidisciplinary background knowledge
- The book “Affective Computing” by Rosalind Picard (Picard (1997)) is considered a good start point, however best literature on this topic has yet to be written



References I

- Hu, M. and Liu, B. (2004). Mining and summarizing customer reviews. In *Proc. 10th ACM SIGKDD Int. Conf. on Knowledge Discovery and Data Mining, KDD'04*, pages 168–177, New York, NY, USA. ACM.
- James, W. (1884). What is an Emotion? *Mind*, 9(34):188–205.
- Kim, S.-M. and Hovy, E. (2006). Identifying and Analyzing Judgment Opinions. In *Proc. Main Conf. on Human Language Technology, Conf. of the North American Chapter of the ACL, HLT-NAACL'06*, pages 200–207, Stroudsburg, PA, USA. ACL.
- Picard, R. W. (1997). *Affective Computing*. MIT Press, Cambridge, MA, USA.
- Turney, P. D. (2002). Thumbs up or thumbs down?: semantic orientation applied to unsupervised classification of reviews. In *Proc. 40th Annual Meeting on ACL, ACL'02*, pages 417–424, Stroudsburg, PA, USA. ACL.
- Vinciarelli, A., Suditu, N., and Pantic, M. (2009). Implicit human-centered tagging. In *Proc. 2009 IEEE Int. Conf, on Multimedia and Expo, ICME'09*, pages 1428–1431, Piscataway, NJ, USA. IEEE Press.



