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DEGLI STUDI DI BARI
ALDO MORO



The Challenges of Affect Detection in the Social Programmer Ecosystem

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Outline Day 2



- The Challenges of Affect Detection in the Social Programmer Ecosystem
 - Part 4 - Affect Detection in the Social Programmer Ecosystem: Opportunities and Open Challenges
 - (15 mins) Break
 - Part 5 - Practicum: Sentiment Analysis with Publicly Available Tools



Software Engineering involves social interaction

- Programmers cooperate, directly or indirectly
- Massive adoption of social media and rise of the 'social programmer' (Storey, '12) and the surrounding ecosystem

Microsoft's Top 10 Questions	Essential	Essential + Worthwhile
1. How do users typically use my application?	80.0%	99.2%
2. What parts of a software product are most used and/or loved by customers?	72.0%	98.5%
3. How effective are the quality gates we run at checkin?	62.4%	96.6%
4. How can we improve collaboration and sharing between teams?	54.5%	96.4%
5. What are the best key performance indicators (KPIs) for monitoring services?	53.2%	93.6%
6. What is the impact of a code change or requirements change to the project and its tests?	52.1%	94.0%
7. What is the impact of tools on productivity?	50.5%	97.2%
8. How do I avoid reinventing the wheel by sharing and/or searching for code?	50.0%	90.9%
9. What are the common patterns of execution in my application?	48.7%	96.6%
10. How well does test coverage correspond to actual code usage by our customers?	48.7%	92.0%

From: A. Begel, T. Zimmermann. Analyze This! 145 Questions for Data Scientists in Software Engineering, ICSE 2014

The Role of Affect



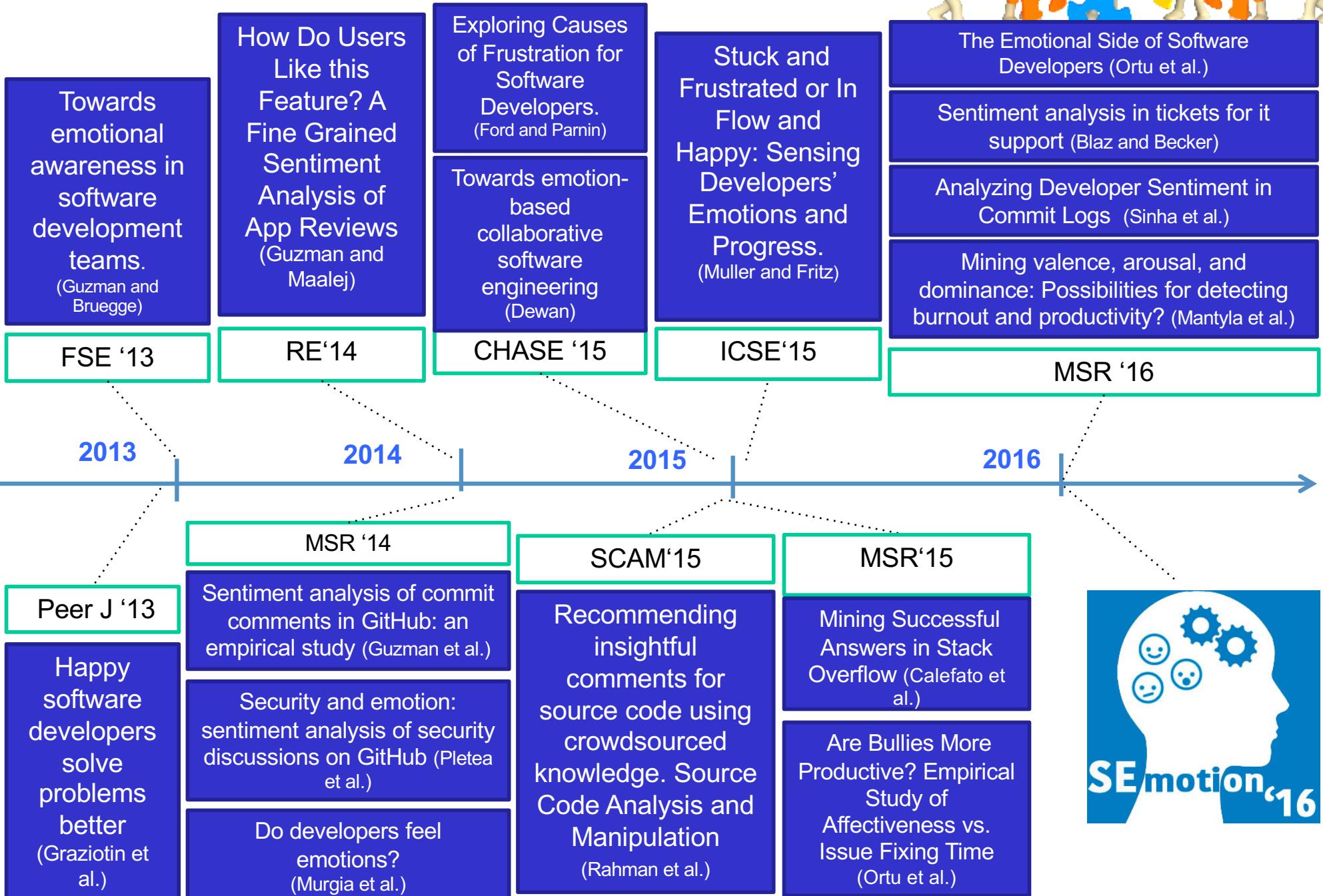
- **Emotion Awareness in Social Software Engineering**
 - Do emotions affect the outcome of collaboration?
 - How to deal with troubles in emotion communication in computer-mediated interaction?
 - How to appropriately convey sentiment through text?





Studying Emotions in Software Engineering

Studying Emotions in Software Engineering



Do Developers Feel Emotions?



- Annotation study on the Apache Software Foundation issue tracking system
 - Wide range of both **positive** and **negative** emotions

Thanks for your input! You're, like, **awesome**.

I'm **happy** with the approach and the code **looks good**

I will come over to your work and **slap you**

Sorry for the delay Stephen



Are Bullies More Productive?



Are Bullies more Productive? Empirical Study of Affectiveness vs. Issue Fixing Time

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*Abstract—Human Affectiveness, i.e., the emotional state of a person, plays a crucial role in many domains where it can make or break a team’s ability to produce successful products. Software development is a collaborative activity as well, yet there is little information on how affectiveness impacts software productivity. As a first measure of this impact, this paper analyzes the relation between sentiment, emotions and politeness of developers in more than 560K Jira comments with the time to fix a Jira issue. We found that the happier developers are (expressing emotions such as *JOY* and *LOVE* in their comments), the shorter the issue fixing time is likely to be. In contrast, negative emotions such as *SADNESS*, are linked with longer issue fixing time. Politeness plays a more complex role and we empirically analyze its impact on developers’ productivity.*

Index Terms—Affective Analysis, Issue Report, Empirical Software Engineering

I. INTRODUCTION

for example in exchanges between the creator of the Linux kernel and some of the Linux developers¹.

In previous research [9], the authors manually analyzed whether discussion boards like bug repositories contain emotional content. They indeed found evidence of gratitude, joy and sadness, and also weak evidence that the presence of emotions like gratitude was related with faster issue resolution time. However, due to the manual nature of the analysis, the data sample was relatively limited. Furthermore, emotions are but one of the possible human affectiveness measures, and might not have the strongest relation with issue resolution time.

In this paper, we empirically analyze more than 560K comments of the Apache projects’ Jira issue tracking system to understand the relation between human affectiveness and developer productivity. In particular, we extract affectiveness

Are Bullies More Productive?



- Emotions such as *JOY* and *LOVE* reduce the resolution time
- Emotions such as *SADNESS* increase the issue resolution time
- Issue average politeness also increases the issue fixing time
- Affective metrics are significant for explaining the issue fixing time
 - Logistic regression model with P=.67, R =.67

Exploring Causes of Frustration for Developers



- Survey of 45 software developers
 - For 67% frustration is a severe problem
- Learning barriers are a major cause of frustration
 - New programming tools and languages
 - New projects
 - Unavailability of resources
- High cognitive complexity and time pressure
 - Misinterpretation of the task
 - Size of task, high cognitive complexity
 - Limited time, task less simple than expected

Do emotions affect performance? (1/3)



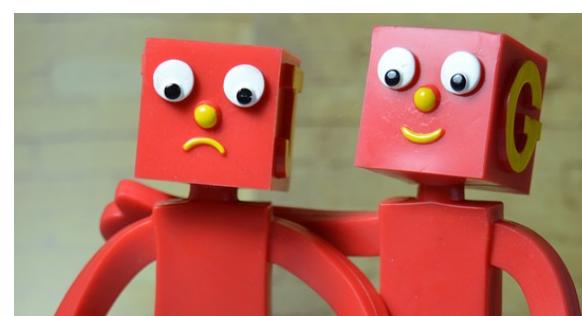
- Positive mood improves debugging performance
- Positive mood induced through physical exercises



Do emotions affect performance? (2/3)



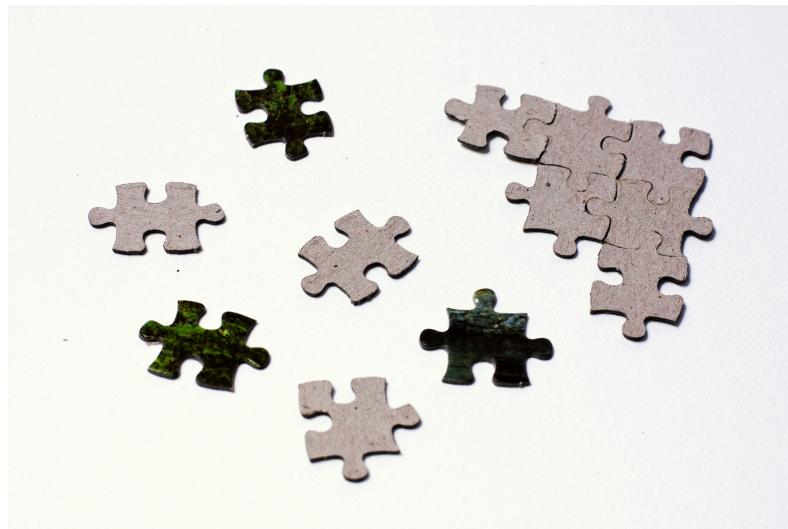
- Emotions is associated to issue tracking activity
 - More comments and watchers for issue where Sadness is expressed
 - Higher fixing time when negative emotions are expressed



Do emotions affect performance? (3/3)



- Emotion and cognition
 - Developers constantly face problem-solving tasks
 - Analysis and creativity skills are required
 - Emotions and moods deeply influence cognitive processing abilities and performance



Benefits

When it comes to our benefits and perks, we have everything you'd expect from a large company, like health insurance, retirement benefits and so on. But we also offer way more than the basics. Our benefits are part of who we are, and they're designed to take care of the whole you and keep you healthy, whether physically, emotionally, financially or socially.

How we think about our benefits

We want to make your life better and easier.

Here's the secret sauce to our benefits and perks: It's all about removing barriers so Googlers can focus on the things they love, both inside and outside of work. We're constantly searching for unique ways to improve the health and happiness of our Googlers. And it doesn't stop there--our hope is that, ultimately, you become a better person by working here.

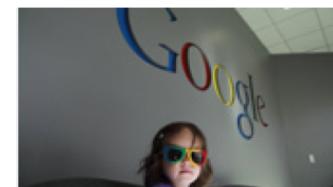
We want our benefits to work for you.

Your interests and needs evolve over your lifetime. Likewise, we evaluate our benefits regularly and adapt them to the needs of our changing population. As with anything at Google, your benefits are an open conversation and your feedback is a part of the equation. You're valuable to us, and our benefits and perks are there to show it.

We care about you AND your family.

Our benefits exist to make sure that you are well taken care of. Your family matters to you, so they're important to us, too. We have a number of benefit programs and onsite amenities to support you and your loved ones through life's various stages and situations. Hey, we're family.

Here's a taste of what we offer



Stay healthy, save time

On-site physicians and nurses, convenient medical

Travel without worries

Googlers and their families are covered with travel

More time with your baby

New parents get time off and some extra spending money

Never stop learning

We'll reimburse you for classes or degree programs

Legal aid for less

Googlers get legal advice at no cost and, in the US, also



Affective Computing as a New Method for Empirical Software Engineering

Multimodal recognition of affective states



- Biometric measurements

empatica

Store ▾ Embrace Watch ▾ E4 Wristband Science Blog Support

For Researchers: E4 wristband

The most comfortable and accurate wristband to monitor physiological signals in real time.



PPG Sensor
Photoplethysmography Sensor - Measures Blood Volume Pulse (BVP), from which heart rate, heart rate variability (HRV), and other cardiovascular features may be derived

3-axis Accelerometer
Captures motion-based activity

Event Mark Button
Tags events and correlate them with physiological signals

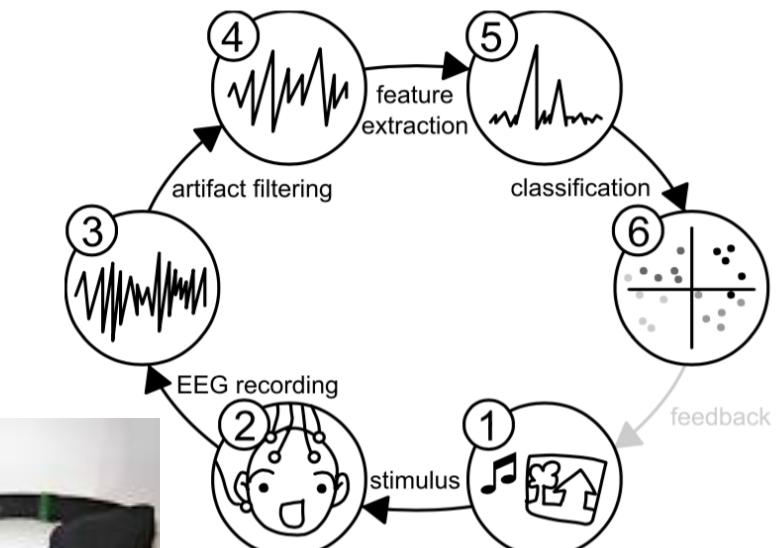
EDA Sensor (GSR Sensor)
Electrodermal Activity Sensor - Used to measure sympathetic nervous system arousal and to derive features related to stress, engagement, and excitement.

Infrared Thermopile
Reads peripheral skin temperature

Internal Real-Time Clock
Temporal resolution up to 0.2 seconds in streaming mode



Need for individual training for each user



- Empatica – www.empatica.com
- Bos, EEG-based Emotion Recognition - Human Media Interaction

Multimodal recognition of affective states



- Biometric measurements
- Facial expression analysis
- Affectiva Developers' Day: <https://www.eventbrite.com/e/emotion-ai-developer-day-tickets-27203573621?aff=WebHome>



Multimodal recognition of affective states



- Biometric measurements
- Facial expression analysis
- Affective natural language processing

Multimodal recognition of affective states



- Biometric measurements
- Facial expression analysis
- Affective natural language processing
- Social signal processing (multimodal)



Social Signal Processing Network

- Negotiation and conflicts
- Communication effectiveness
- Role recognition
- Display of status
- Power relationships and dominance
- Automatic personality perception

Affective computing as a new method for SE (1/3)



- Sensing affect from biometric measures



- Recognizing “in flow” vs. stuck developers
 - In flow developers should not be disturbed
 - Stuck developers need recommendations

Affective computing as a new method for SE (2/3)



- Affective natural language processing
- Software requirements evolution
 - Feature-based sentiment analysis of app reviews
(Guzman and Maalej, 2015)
- Crowdsourced documentation
 - Exploiting sentiment polarity to assess usefulness of comments in Stack Overflow
(Rahman et al., 2015)



Guzman and Maalej, 2015 - How Do Users Like This Feature? A Fine Grained Sentiment Analysis of App Reviews - Requirements Engineering Conference (RE), 2014

Rahman et al., 2015 - Recommending insightful comments for source code using crowdsourced knowledge. Source Code Analysis and Manipulation (SCAM), 2015

Affective computing as a new method for SE (3/3)



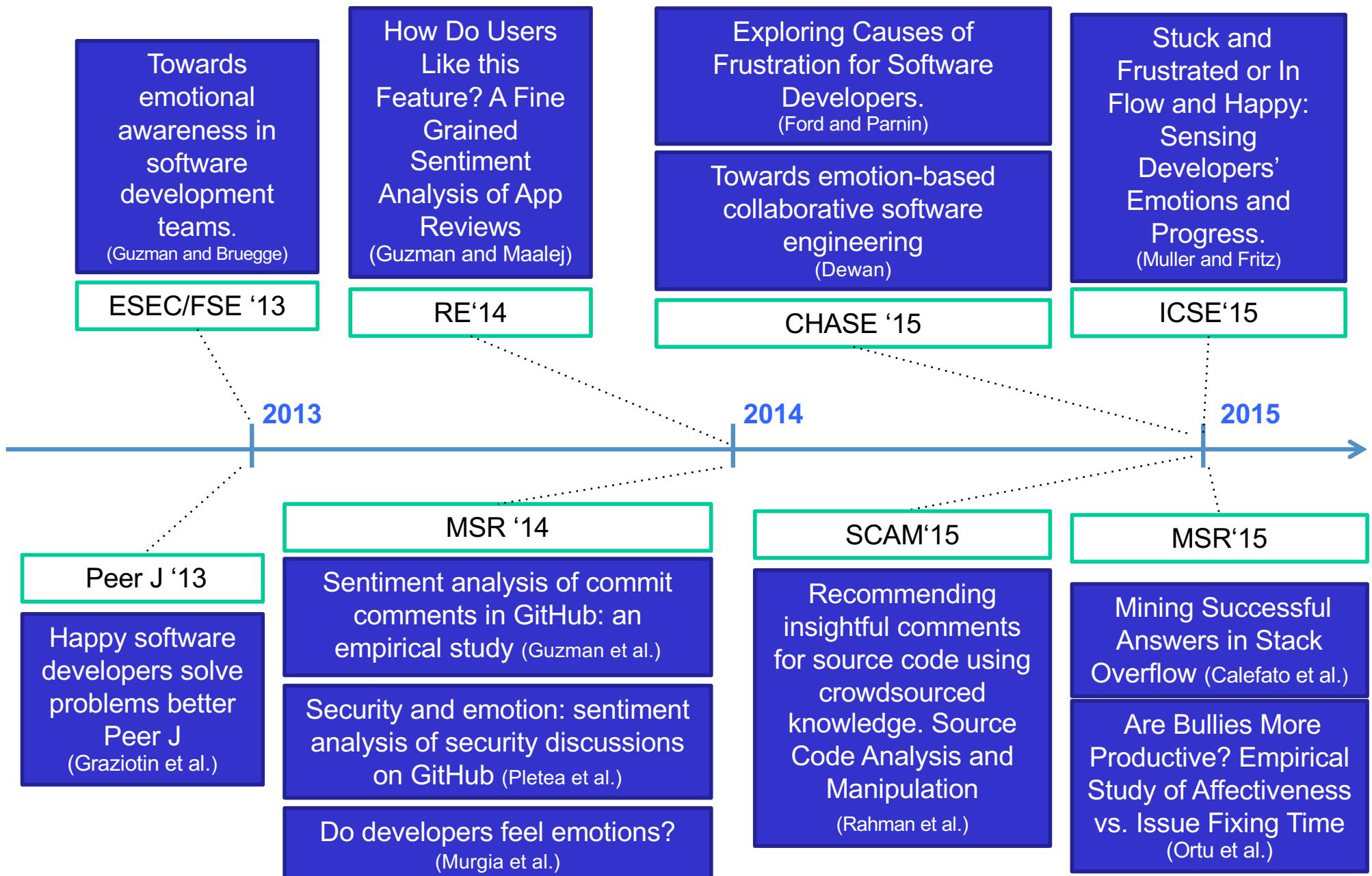
- **Affective natural language processing**
- Improve team collaboration
 - Sentiment analysis of communication artifacts for emotional awareness in development teams
(Guzman and Bruegge, 2013) (Ortu et al, 2015 and 2016)
- **Crowdsourced knowledge**
 - Investigating the role played by emotions in success of information seeking in community-based Question & Answering (Calefato et al., 2015)



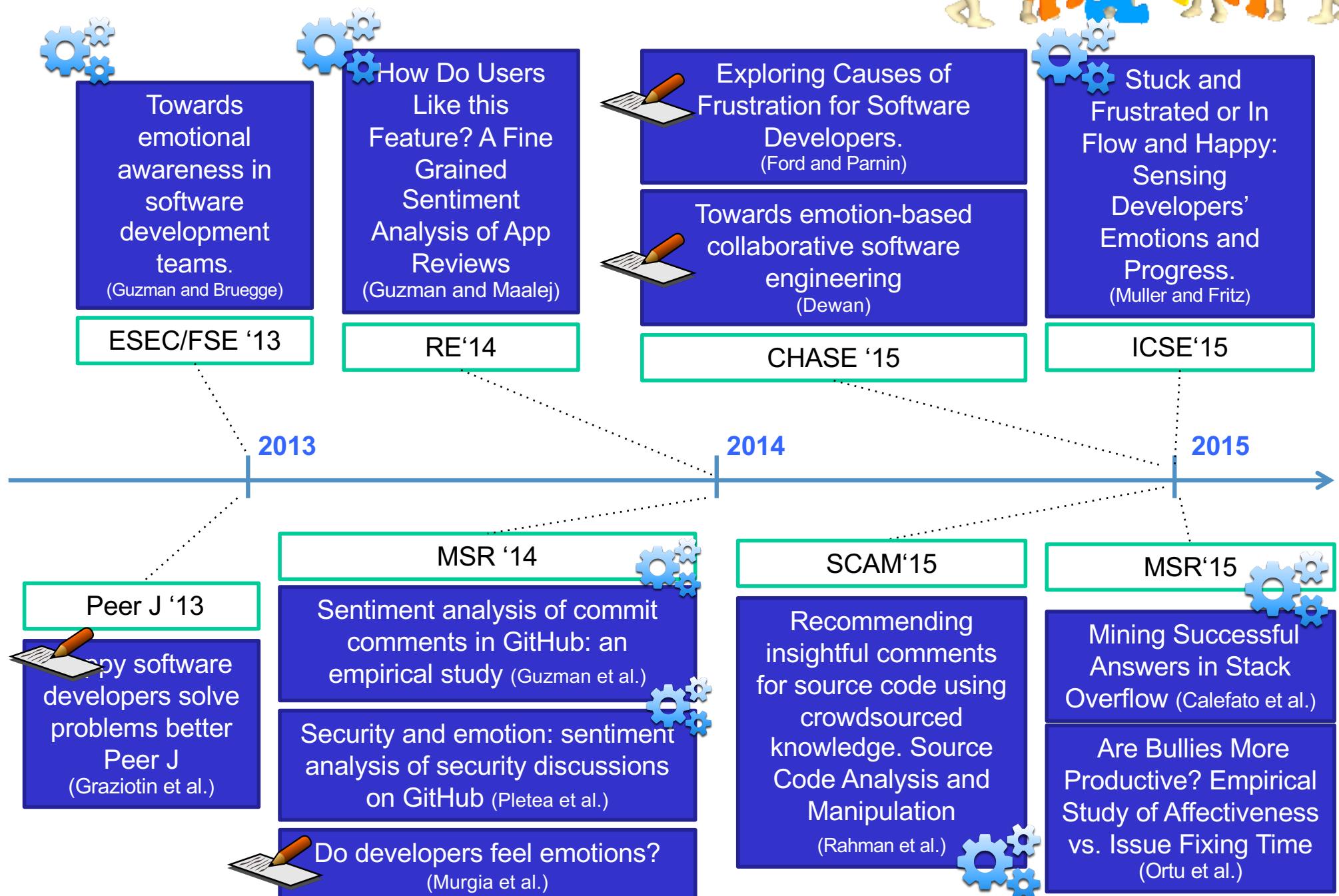


How can we model and detect emotions?

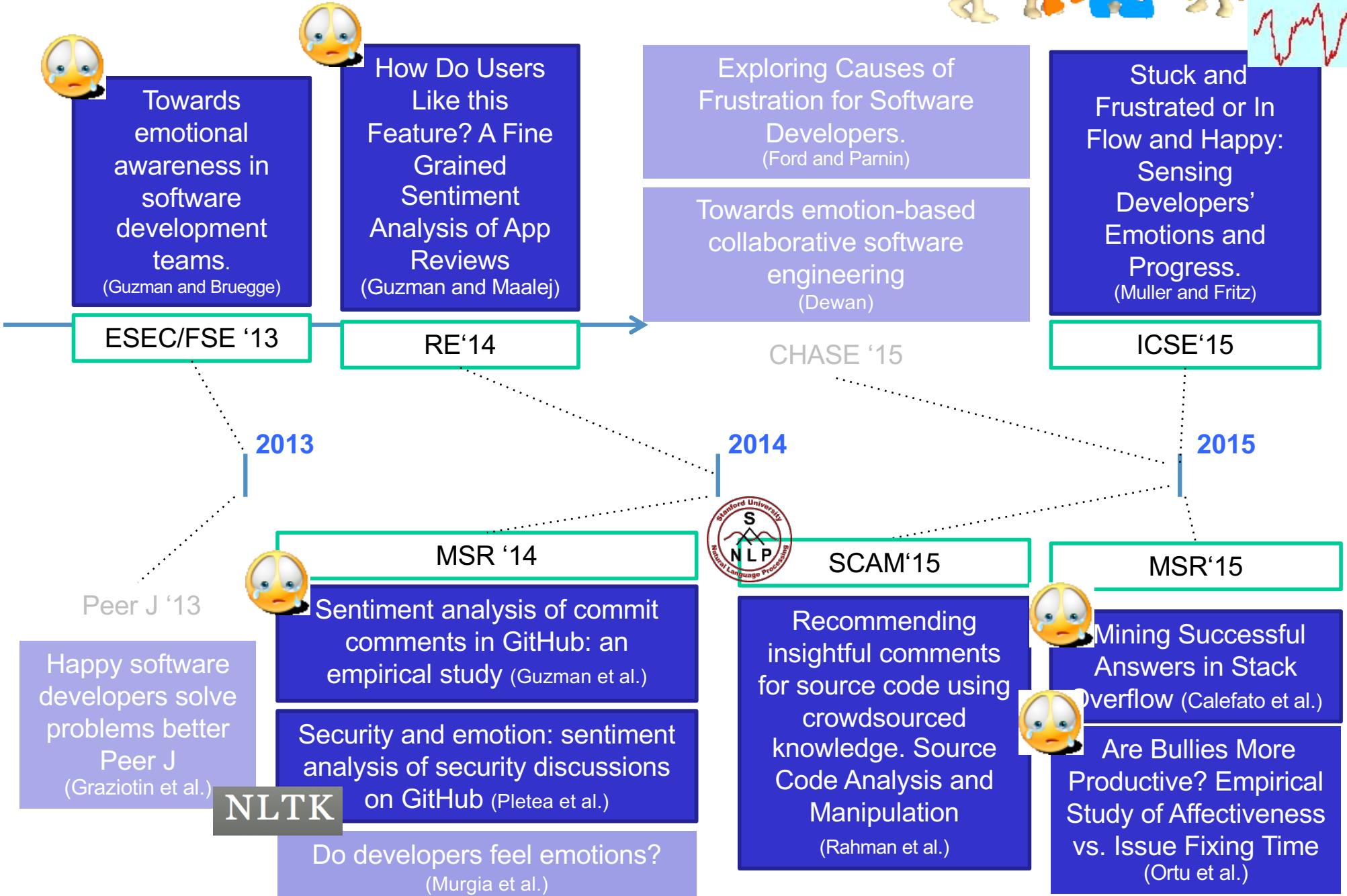
How can we model and detect emotions?



How can we model and detect emotions?



How can we model and detect emotions?





Polarity classification

- Classification of a text according to its *positive*, *negative* or *neutral* semantic orientation
- Several tools available
 - NLTK

NLTK



- Outputs probability for each polarity class
- Trained on tweets and movie reviews
- Stanford Sentiment Analyzer
 - Issues an overall polarity label + representation of the sentence structure
 - Trained on movie reviews
- SentiStrength
 - Outputs a score for both positive and negative sentiment
 - Designed for and validated on general purpose social media



[1] – NLTK: <http://text-processing.com/>

[2] – Stanford Sentiment Analyser - <http://nlp.stanford.edu/sentiment/>

[3] – SentiStrength - <http://sentistrength.wlv.ac.uk/>

Early Detection of Burnout



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ABSTRACT

Similar to other industries, the software engineering domain is plagued by psychological diseases such as burnout, which lead developers to lose interest, exhibit lower activity and/or feel powerless. Prevention is essential for such diseases, which in turn requires early identification of symptoms. The emotional dimensions of Valence, Arousal and Dominance (VAD) are able to derive a person's interest (attraction), level of activation and perceived level of control for a particular situation from textual communication, such as emails. As an initial step towards identifying symptoms of productivity loss in software engineering, this paper explores the VAD metrics and their properties on 700,000 Jira issue reports containing over 2,000,000 comments, since issue reports keep track of a developer's progress on addressing bugs or new features. Using a general-purpose lexicon of 14,000 English words with known VAD scores, our results show that issue reports of different type (e.g., Feature Request vs. Bug) have a fair variation of Valence, while increase in issue priority (e.g., from Minor to Critical) typically increases Arousal. Furthermore, we show that as an issue's resolution time increases, so does the arousal of the individual the issue is assigned to. Finally, the resolution of an issue increases valence, especially for the issue Reporter and for quickly addressed issues. The existence of such relations between VAD and issue report activities shows promise that text mining in the future could offer an alternative way for work health assessment surveys.

Dominance (“VAD”) affect representation to conceptualize an individual’s emotional spectrum. These studies showed a positive relationship between software developers’ productivity and how they enjoyed a situation (high “Valence”) and were feeling in control of the development task (high “Dominance”). In psychology and management, it is generally accepted that increased alertness or readiness to act (high “Arousal”), improves employees’ performance (typically because of time pressure or reward-punishment schemes). This has been shown to apply to software engineering as well [31, 26].

Yet, changes in affect in terms of VAD can also have adverse effects. Increases in Arousal start to hamper performance from a certain threshold (Yerkes-Dodson law [46]), with Arousal caused by increased and prolonged pressure even leading to burnout in software teams [38]. This is why major IT companies like Google have promoted various remediation techniques such as mindfulness training [40]. It has also been shown that a high need for independence, which can be linked to Dominance, is one of the factors characterizing software engineers [4]. Hence, lack of such independence or control at work, increases the risks of burnout in software development [38]. In other words, studies on the emotions of VAD dimensions in software engineering are important as they possibly could identify symptoms of high productivity, i.e., when someone experiences high valence, dominance and arousal, but also symptoms of where the risk of burnout



What model and recognition approaches are suitable to detect the affect of programmers in a reliable manner?

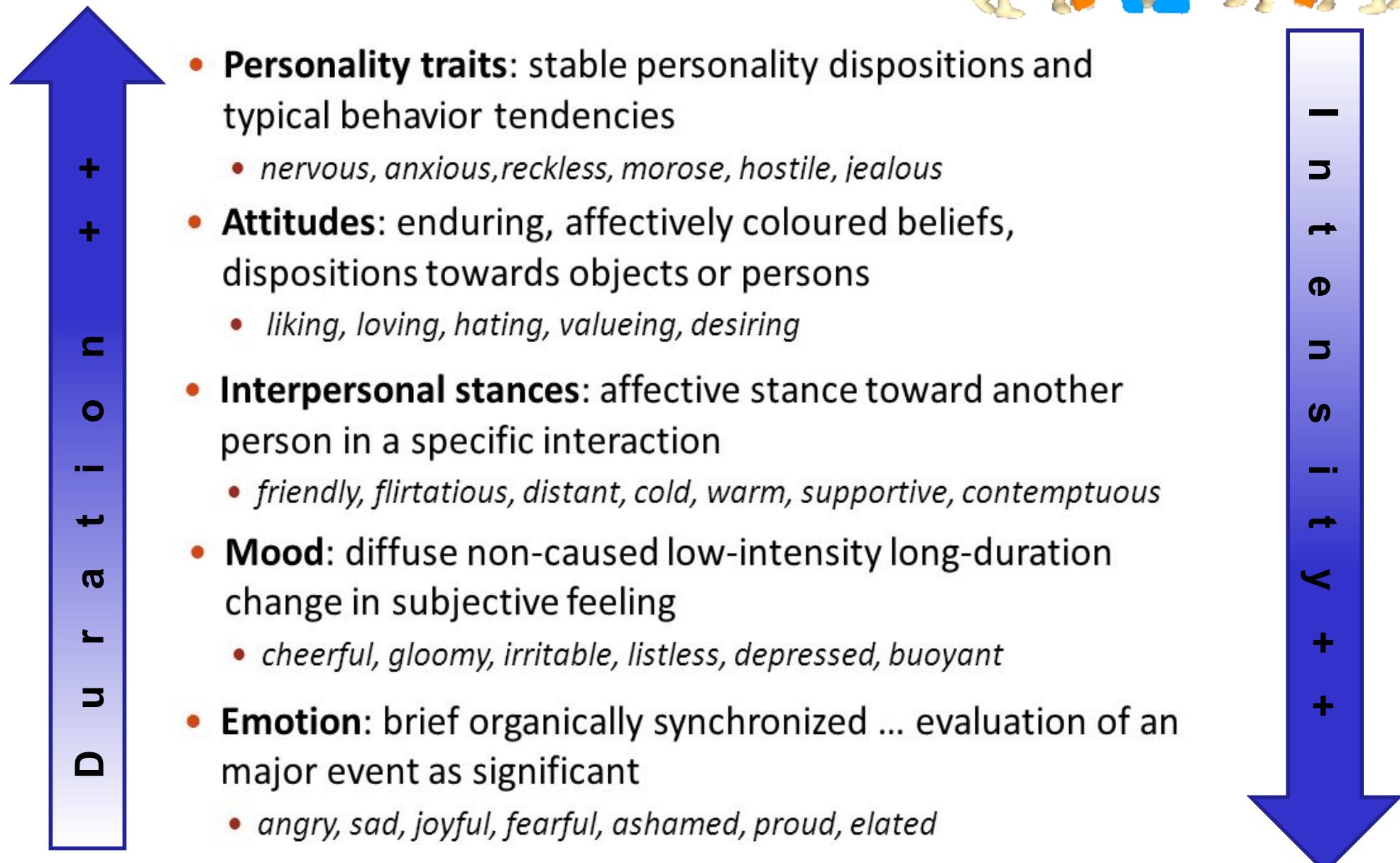
- Which is the best model?
- How to operationalize it?
- What tools/resources are available?

It depends...



- On research goals and application domain
 - Why do you want to model and detect affect?
- On the available source of data
 - Sensors: biometric measurements
 - Written text: natural language processing and conversational analysis
 - Speech: acoustic and prosodic features
 - Cameras/Eye tracking devices: body posture, gaze, facial analysis

Typology of Affective States

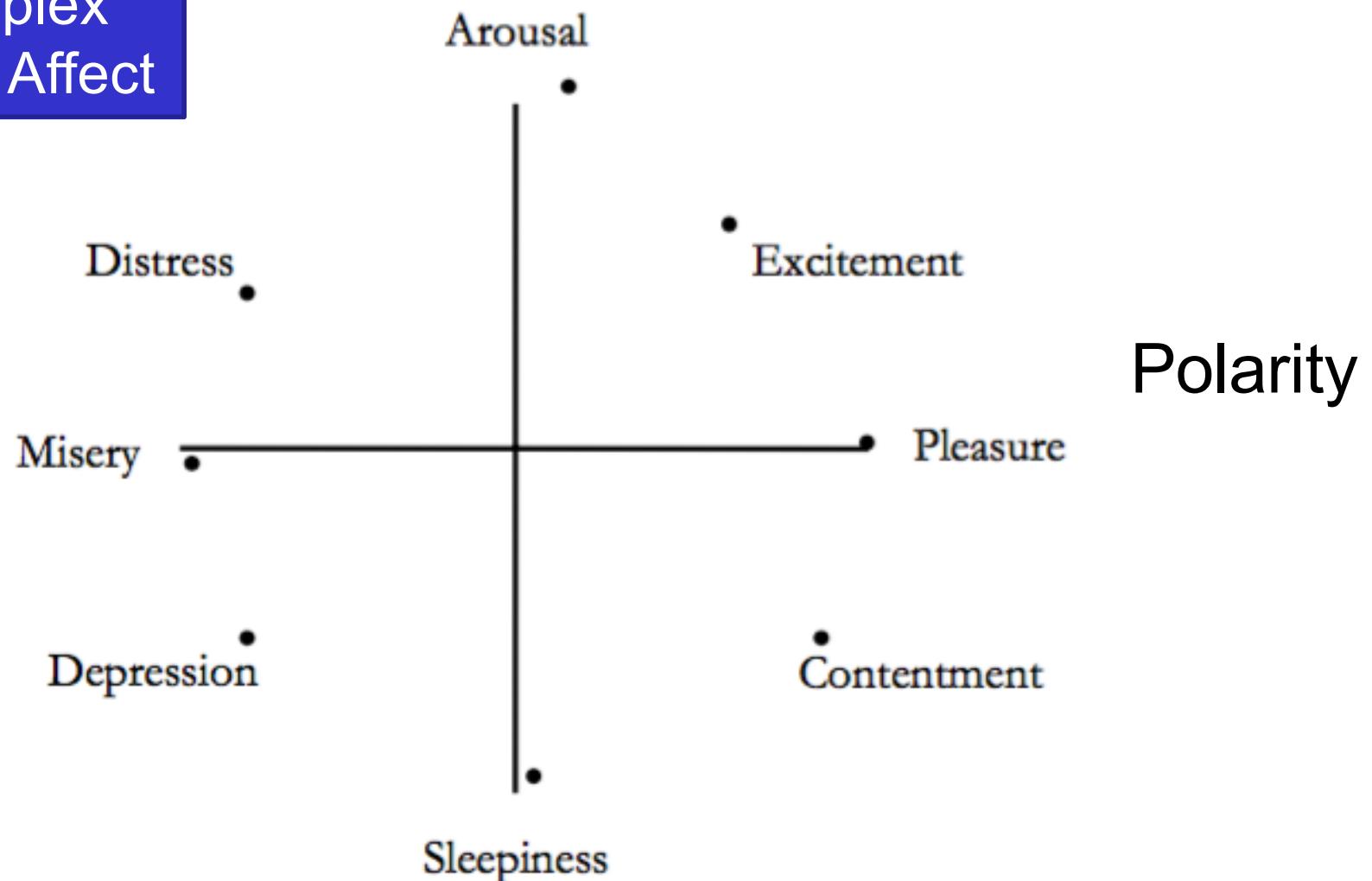


Scherer, 1984. Emotion as a Multicomponent Process: A model and some cross-cultural data. In P. Shaver, ed., Review of Personality and Social Psych 5: 37-63.

Continuous vs. Discrete Emotion Models (1/4)



Circumplex
Model of Affect



Continuous vs. Discrete Emotion Models (2/4)



Ekman's basic emotions



Anger

Fear

Disgust

Surprise

Happiness Sadness

Continuous vs. Discrete Emotion Models (3/4)



Lazarus' framework

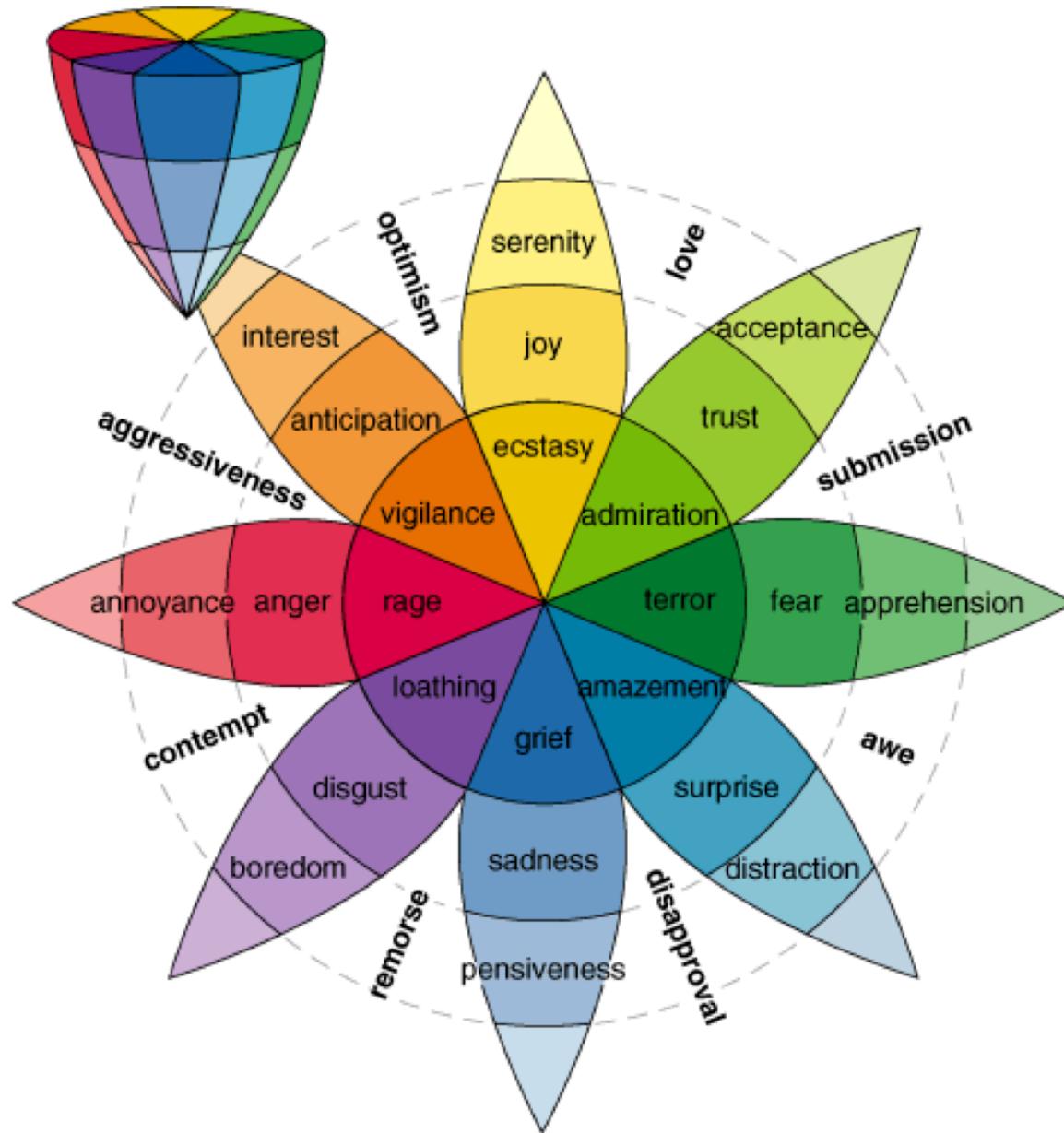
Based on appraisal theory

Negative Emotions	Positive Emotions	Mixed Emotions
anger	happiness	hope
fright	pride	compassion
anxiety	relief	gratitude
guilt	love	
shame		
sadness		
envy		
jealousy		
disgust		

Continuous vs. Discrete Emotion Models (4/4)



Plutchik's
Wheel





Many others...

Mining Affect from Text



	Sentiment Analysis	Emotion Detection
Goal	Negative vs. Positive Sentiment Strength	Classification using Discrete Emotion Labels
Example	<p><i>'I can't solve this problem, it's very frustrating'</i></p> <p><i>Negative</i></p>	<p><i>'I can't solve this problem, it's very frustrating'</i></p> <p><i>Frustration</i></p>
Resources	<p>SentiStrength (Thelwall et al., 2012)</p> <p>SentiWordNet (Esuli and Sebastiani, 2006)</p> <p>MPQA Lexicon (Wilson et al., 2005)</p>	<p>WordNet Affect (Strapparava and Valitutti, 2004)</p> <p>NRC Emotion Lexicon (Mohammad and Turney, 2010)</p> <p>Depeche Mood (Staiano and Guerini, 2014)</p>

SentiWordNet



P	N	Scores	Sense ID and gloss	
		<i>as an adjective</i>		
		Positive = 0.75 Negative = 0 Objective = 0.25	good#1 - Having desirable or positive qualities especially those suitable for a thing specified (as in 'a good joke')	
		<i>as a noun</i>		
		Positive = 0.5 Negative = 0 Objective = 0.5	good#1 benefit (as in 'for your own good')	
		Positive = 0 Negative = 0 Objective = 1	good#4 commodity, article of commerce	

Wordnet Affect



A-label	Example of Synsets
EMOTION	noun 'anger', verb 'fear'
MOOD	noun 'animosity', adjective 'fear'
TRAIT	noun 'aggressiveness', adj. 'competitive'
COGNITIVE State	noun 'confusion', adj. 'dazed'
PHYSICAL State	noun 'illness'
HEDONIC Signal	noun 'hurt', noun 'suffering'
Emotion-eliciting SITUATION	noun 'awkwardness'
Emotional RESPONSE	noun 'cold sweat', verb 'tremble'
BEHAVIOR	noun 'offense', adj. 'inhibited'
ATTITUDE	noun 'intolerance', noun 'defensive'
SENSATION	noun 'coldness', noun 'feel'

Emotion Detection in the Social Programmer Ecosystem



- Data source: written, asynchronous communication on social media



- Goals
 - To prevent negative emotion from negatively affecting outcome of collaboration
 - To support developers in appropriately convey sentiment through text
 - To exploit emotion mining for improving the creation of crowdsourced knowledge

Research Question



**How to reliably detect the affective states
of programmers in textual
communication artifacts?**

- What affect model should we adopt?
- What are the main drawbacks of applying state-of-the-art sentiment analysis techniques in the SE domain?
- What tools and linguistic resources should be used and how can they be improved and adapted to the SE domain?

A Preliminary Investigation on Stack Overflow



The screenshot shows the Stack Exchange homepage with the following details:

- Stack Exchange** logo at the top left.
- Navigation bar at the top right: All Sites, Top Users, Newsletters, Blogs.
- Filter bar below the navigation: All, Technology, Culture / Recreation, Life / Arts, Science, Business, Professional.
- Stack Overflow** section:
 - Icon: A stack of books.
 - Name: Stack Overflow.
 - Description: Q&A for professional and enthusiast programmers.
 - Statistics: questions 10m, answers 17m, answered 74%, users 4.6m.
 - Recent question: "How is it known that variables are in registers, or on stack?" - asked 15 hours ago.
 - User icons: Five small user avatars.
 - Buttons: Visit Site, ask, WordPress Development, English.
- Server Fault**: Red box with a server icon.
- Super User**: Blue box with a brace icon.
- Mathematics**: Dark blue box with a red geometric shape icon.
- Arqade**: Dark blue box with a castle icon.
- Other sites shown in bubbles:** Webmasters, Seasoned Advice, Game Development, Photography, Cross Validated, Home Improvement, Geographic Information Systems, TeX - LaTeX, Stack Apps, User Experience, Unix & Linux.

35

Let's say I have a `DataTable` with a `Name` column. I want to have a collection of the unique names ordered alphabetically. The following query ignores the order by clause.

2

```
var names =  
    (from DataRow dr in dataTable.Rows  
     orderby (string)dr["Name"]  
     select (string)dr["Name"]).Distinct();
```

Why does the `orderby` not get enforced?

c# linq .net-3.5

[share](#) | [improve this question](#)

edited Jan 1 at 16:43



i3arnon

14.7k ● 4 ● 30 ● 51

asked Aug 1 '08 at 13:14



Bob

37.1k ● 15 ● 87 ● 102

[add a comment](#)

5 Answers

active

oldest

votes

7

To make it more readable and maintainable, you can also split it up into multiple LINQ statements.

✓

1. First, select your data into a new list, let's call it `x1`, do a projection if desired
2. Next, create a distinct list, from `x1` into `x2`, using whatever distinction you require
3. Finally, create an ordered list, from `x2` into `x3`, sorting by whatever you desire

[share](#) | [improve this answer](#)

edited Oct 14 '12 at 12:22



flem

13.3k ● 4 ● 22 ● 59

answered Sep 4 '08 at 2:57



a7drew

4,195 ● 3 ● 22 ● 34

2 @Bob's answer seem the best and uses the lease lines of code – [CodeBlend](#) Aug 6 '12 at 16:00

Stack Overflow dataset



- Questions, Answers and relative comments from the Stack overflow official (May 2014)
- 800 items in our dataset
 - We opportunistically chose items with the highest positive and negative polarity scores (SentiStrength)
 - 200 questions and 200 follow-up askers' comments (400 cases overall)
 - 200 top answers and 200 follow-up answerers' comments (400 additional cases).

Negative and Positive Sentiment in Stack Overflow



	Negative Sentiment detected	Positive Sentiment detected
In Questions	<p><i>Negative attitude towards technical issues</i></p> <ul style="list-style-type: none">- <i>Emotions</i> such as Frustration- <i>Negative Opinions</i> about, tools, languages, IDE, etc.	<p><i>Positive attitude towards technical issues</i></p> <ul style="list-style-type: none">- <i>Positive Opinions</i> about, tools, languages, IDE, etc.
In Comments	<p><i>Negative attitude towards technical issues</i></p> <ul style="list-style-type: none">- <i>Negative Opinions</i> about, tools, languages, IDE, etc.	<p><i>Positive attitude towards technical issues</i></p> <ul style="list-style-type: none">- <i>Positive Opinions</i> about, tools, languages, IDE, etc.
	<p><i>Negative attitude towards interlocutor</i></p> <ul style="list-style-type: none">- <i>Emotions</i> such as Anger	<p><i>Positive attitude towards interlocutor</i></p> <ul style="list-style-type: none">- <i>Emotion</i> such as Liking, Appreciation or Gratitude

Negative attitude towards the interlocutor



- **Disliking**
 - 'Didn't notice the horrid inline jQuery'
 - 'Added some instructions for the really hopeless cases'
- **Anger**
 - 'Do u know the answer? If not then u might know how hard is homework. Ignorance is bliss'
 - 'Arrrghhh, how I hate those people who downvote answers without leaving a comment as for why the downvote...'

Negative attitude towards the interlocutor



- Detecting hostile behaviour

'Didn't notice the horrid inline jQuery'

'Added some instructions for the really hopeless cases'

'Do u know [the] answer ? If not then u might know how hard is homework. Ignorance is bliss'

Relevant for community moderators



Questions Tags Users Badges

Be nice.

Whether you've come to ask questions, or to generously share what you know, remember that we're all here to learn, together. Be welcoming and patient, especially with those who may not know everything you do. Oh, and bring your sense of humor. Just in case.

That basically covers it. But these three guidelines may help:

1. **Rudeness and belittling language are not okay.** Your tone should match the way you'd talk in person with someone you respect and whom you want to respect you. *If you don't have time to say something politely, just leave it for someone who does.*

Negative attitude towards the interlocutor



- Hostile behavior is a problem for the Stack Exchange community

The screenshot shows the Meta Stack Exchange homepage. At the top, there's a navigation bar with links for 'sign up', 'log in', 'tour', 'help', and a search bar. Below the navigation is a main menu with 'Questions', 'Tags', 'Users', 'Badges', 'Unanswered', and a 'Ask Question' button. On the left side, there's a large 'META' logo with a speech bubble icon. A banner at the bottom of the page reads: 'Meta Stack Exchange is where users like you discuss bugs, features, and support issues that affect the software powering all 149 Stack Exchange communities.' There's also a 'What is meta?' link and a close button.

Could we please be a bit nicer to new users?

- 1390 There is a distinct decline in the level of civility on all sites. I think it's because more users coming in and posting spam and other nonsense. I think the moderation system is doing a pretty good job of keeping this under control.
- 151 Unfortunately, a lot of this is coming from more experienced users. The new moderation system is not (and probably cannot) handle this. It's hard to tell new users down with "this belongs on meta!", "this is offtopic", or "this is a duplicate". (Which is correct, but should be done nicer) A lot of new users are getting a lot of downvotes. This is not very welcoming to new users.

The screenshot shows the Meta Stack Exchange homepage. At the top, there's a navigation bar with links for 'sign up', 'log in', 'tour', 'help', and a search bar. Below the navigation is a main menu with 'Questions', 'Tags', 'Users', 'Badges', 'Unanswered', and a 'Ask Question' button. On the left side, there's a large 'META' logo with a speech bubble icon. A banner at the bottom of the page reads: 'Meta Stack Exchange is where users like you discuss bugs, features, and support issues that affect the software powering all 149 Stack Exchange communities.' There's also a 'What is meta?' link and a close button.

Stack Exchange is too harsh to new users—please help them improve low-quality posts and avoid being uncivil [duplicate]

Positive attitude towards the interlocutor



- Positive polarity, positive attitude
 - Gratitude
 - Thanks, that helped. Case closed!
 - Worked perfectly, thanks a lot
- Often positive feedback is provided for discussion threads without an accepted answer
 - 'Thanks for the feedback, it was a pleasure!
Could please accept my answer?'
- Remind information seekers to accept useful answers!

Attitude towards technical issues



- **Frustration**
 - I am not sure what I did in a previous life to warrant this, it must have been bad! I am getting buried in a world of xml [...]
 - This is driving me nutz :-(
 - There's no way to do this I'm afraid :(
- **Negative opinions**
 - They use it to clean up connections, which is really scary
 - It is very painful to add multiple tickets to Trac
 - I find this incredibly annoying with Dreamweaver

Exploiting negative affect towards technical issues



Detect negative sentiment



Detect controversial technical issues or questions that are not exhaustively answered



• Gold Badge



Does polarity capture the true sentiment? (1/2)



- Negative polarity, positive attitude
 - Sorry-for
 - 'To explain my regrettably unfriendly comment (sorry about that)'
 - 'I'm afraid I can't help you any further with this issue!'

Does polarity capture the true sentiment? (2/2)



- Humor, an open challenge for affective NLP
 - Irony
 - 'Haha that comment made me laugh my heart out.
Makes me kind of proud of how horrible my code can be'
- (positive sentiment = 3; negative sentiment = -4)*
- Sarcasm
 - 'Ignorance is bliss'
- (positive sentiment = 5; negative sentiment = -3)*

Emotion or politeness?



- Positive polarity
 - Gratitude

'Thanks for the feedback, it was a pleasure!'
- Negative polarity, positive attitude
 - Sorry-for

'I'm afraid I can't help you any further with this issue!'

True emotions might not be necessary involved!
Politeness, 'Behabitive' speech acts

Domain dependence of sentiment-analysis



- False positives in negative sentiment detection

- Domain lexicon

'What is the best way to **kill** a critical process'



- Contextual semantics

'I am **missing** a parenthesis. But where?



- Context of interaction (Q&A)

'I have a problem, [...] please explain what is **wrong**'



Main findings



- Emotions emerge especially in comments
 - Seen as a ‘free zone’, comments do not contribute to reputation
- Need to distinguish between the emotions towards somebody (i.e. the reader) vs. something (i.e. technical issues)
 - Relevant to different contexts and research goals
- Distinguish politeness from true emotions
- Domain-dependence of sentiment analysis
 - Need for tuning tools and linguistic resources

Project EmoQuest

<http://collab.di.uniba.it/emoquest>



Investigating the Role of Emotions in Social Q&A Sites

Impact in Computer-Supported Cooperative Work

SOFTWARE ENGINEERING

HUMAN-COMPUTER INTERACTION

PSYCHOLOGY

LINGUISTICS

Expected Results



SOCIAL SOFTWARE ENGINEERING

- Netiquette: pragmatic and actionable synthesis for emotional awareness
- Software tools for embedding emotional intelligence into Q&A platforms

AFFECTIVE COMPUTING

- Empirically-driven guidelines for emotional interface design
- Fine-grained Sentiment Analysis tools exploiting lexical semantics and unsupervised approaches
- Real-time modeling of affect in collaboration dialogues in social media

PSYCHOLINGUISTICS

- New psycholinguistic theories and models of social emotions in computer-mediated interaction

APPLIED LINGUISTICS

- New models of affect expression through language in social computing

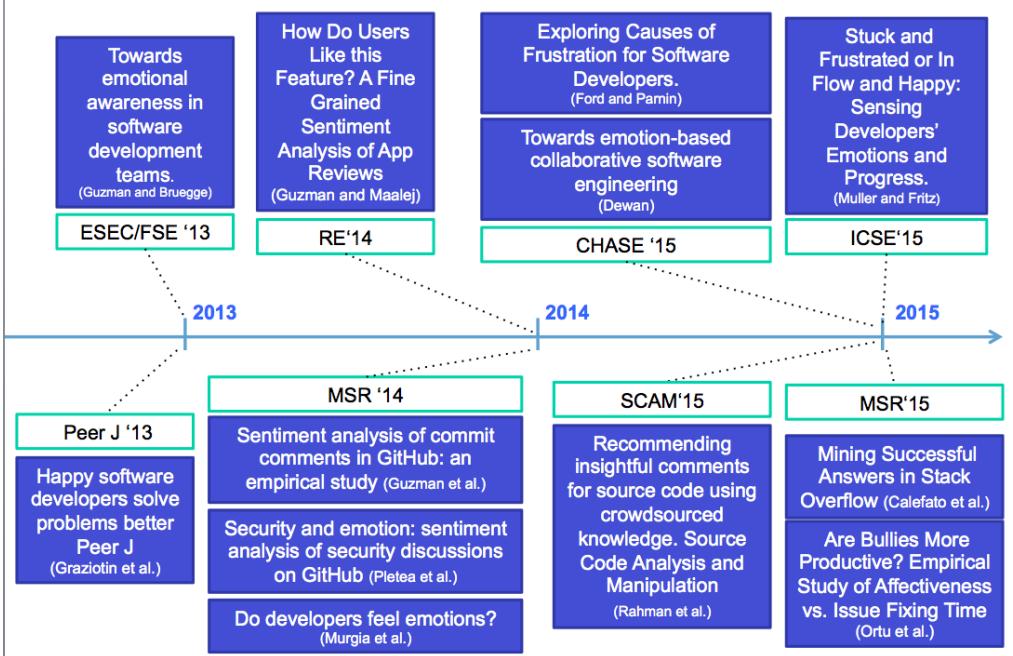


The Role of Affect

- Emotion Awareness in Social Software Engineering**
 - Do emotions affect the outcome of collaboration?
 - How to deal with troubles in emotion communication in computer-mediated interaction?
 - How to appropriately convey sentiment through text?

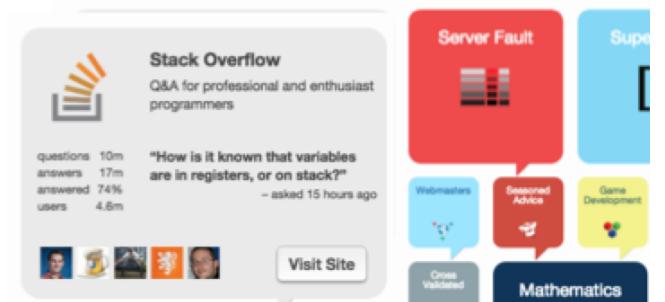


Studying Emotions in Software Engineering



What model and recognition approaches are suitable to detect the affect of programmers in a reliable manner?

A Preliminary Investigation on Stack Overflow





SENTIMENT ANALYSIS WITH PUBLICLY AVAILABLE TOOLS

SentiStrength

<http://sentistrength.wlv.ac.uk/>



- Unsupervised approach
- Estimates the *strength* of *both* positive and negative sentiment in a text



*Emotion
Lookup table*

Input text



Positive Sentiment Score

Negative Sentiment Score

In [1,5]

In [-1,-5]

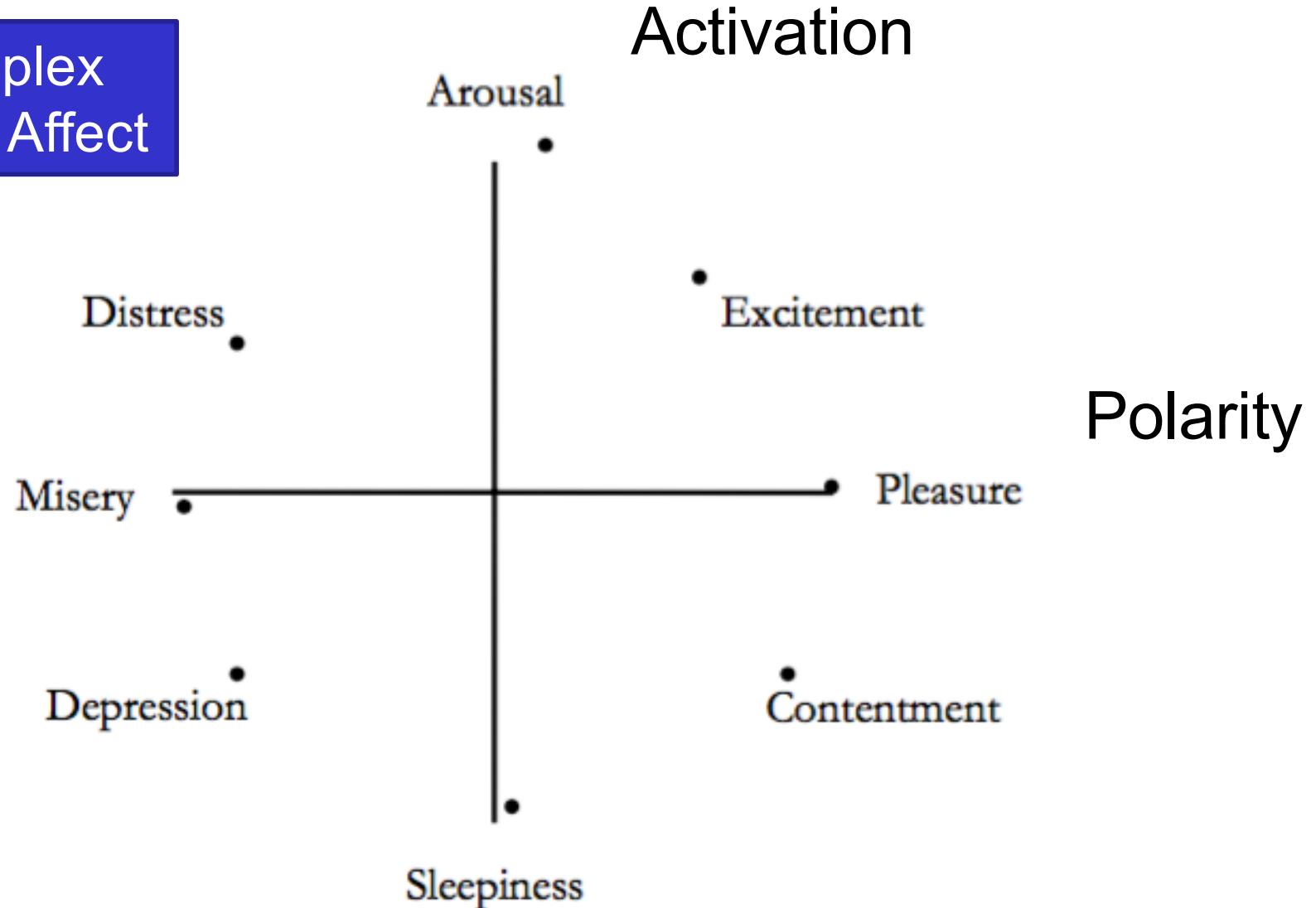
where ± 1 indicates absence of pos/neg sentiment

- Robust also for informal language
- Widely employed in social computing

Russel's Circumplex Model



Circumplex
Model of Affect



Sentiment annotation with SentiStrength



Input text	Positive	Negative
Any help would be really great! :-)	5	-1
@<username> - what's the emoticon for being terribly embarrassed!	1	-5
I have very simple and stupid trouble [...] I am pretty confused, explain please, what is wrong? Any help would be greatly appreciated.	3	-3

How are these scores calculated?

SentiStrength



Emotion Lookup table

abandon*	-2	LIWC
abate	-2	General Inquirer Feb 2010
abdicate*	-2	General Inquirer Feb 2010
abhor*	-4	General Inquirer Feb 2010
abject	-2	General Inquirer Feb 2010
abnormal*	-2	General Inquirer Feb 2010
accusation*	-2	General Inquirer Feb 2010
[...]		

Emotion Lookup Table

Inflected Forms



- miss -2 General Inquirer Feb 2010
- missed -2
- misses -3

Other Word Lists



- Booster words
- Emoticon Lookup Table
- Idiom Lookup Table
- Negating Word List
- Question Words
- Slang Lookup Table

How SentiStrength Works



- Launch SentiStrength using the ‘explain’ option

```
java -jar SentiStrengthCom.jar sentidata  
./SentStrength_Data_Sept2011/ text I+hate+you. explain
```

- Output

```
1 -4 I hate[-4] you .[sentence: 1,-4]  
[result: max + and - of any sentence]  
[overall result = -1 as pos<-neg]
```

How SentiStrength Works



- Launch SentiStrength using the ‘explain’ option

```
java -jar SentiStrengthCom.jar sentidata  
./SentStrength_Data_Sept2011/ text I+absolutely+hate+you.  
explain
```

- Output

```
1 -5 I absolutely hate[-4] [-1 booster word] you .[sentence: 1,-5]  
[result: max + and - of any sentence]  
[overall result = -1 as pos<-neg]
```

How SentiStrength Works



- Launch SentiStrength using the ‘explain’ option

```
java -jar SentiStrengthCom.jar sentidata  
./SentiStrength_Data_Sept2011/ text I+love+you. explain
```

- Output

```
3 -1 I love[3] you .[sentence: 3,-1]  
[result: max + and - of any sentence]  
[overall result = 1 as pos>-neg]
```

How SentiStrength Works



- Launch SentiStrength using the ‘explain’ option

```
java -jar SentiStrengthCom.jar sentidata  
./SentStrength_Data_Sept2011/ text I+absolutely+love+you.  
explain
```

- Output

```
4 -1 I absolutely love[3] [+1 booster word] you .[sentence: 4,-1]  
[result: max + and - of any sentence]  
[overall result = 1 as pos>-neg]
```



Mixed Sentiment

- Launch SentiStrength using the ‘explain’ option

```
java -jar SentiStrengthCom.jar sentidata  
./SentiStrength_Data_Sept2011/ text I+hate+and+love+you.  
explain
```

- Output

```
3 -4 I hate[-4] and love[3] you  
[sentence: 3,-4] [result: max + and - of any sentence]  
[overall result = -1 as pos<-neg]
```

Effect of Punctuation Emphasis



- Launch SentiStrength using the ‘explain’ option

```
java -jar SentiStrengthCom.jar sentidata  
./SentStrength_Data_Sept2011/ text I+hate+and+love+you!  
explain
```

- Output

```
3 -5 I hate[-4] and love[3] you ![-1 punctuation emphasis]  
[sentence: 3,-5]  
[result: max + and - of any sentence]  
[overall result = -1 as pos<-neg]
```



Effect of Negations

- Negating negative terms makes them neutral rather than positive

```
java -jar SentiStrengthCom.jar sentidata  
./SentStrength_Data_Sept2011/ text I+do+not+hate+you  
explain
```

```
1 -1 I do not hate[-4] [=0 negation] you [sentence: 1,-1]  
[result: max + and - of any sentence]  
[trinary result = 0 as pos=1 neg=-1]
```

Neg + Intensifier



- Result of combination is different

```
java -jar SentiStrengthCom.jar sentidata  
./SentStrength_Data_Sept2011/ text I+do+not+hate+you!  
explain
```

2 -1 I do not hate[-4] [=0 negation] you ![+1 punctuation mood emphasis] [sentence: 2,-1]
[result: max + and - of any sentence]
[overall result = 1 as pos>-neg]

I+asolutely+do+not+hate+you

1 -1 I absolutely do not hate[-4] [=0 negation] you [sentence: 1,-1]
[result: max + and - of any sentence]
[overall result = 0 as pos=1 neg=-1]

SentiStrength Dataset



- BBC Forum posts
 - Public news-related discussions about various serious topics
- Digg.com posts
 - Public comments on general news stories
- MySpace comments:
 - Public messages between Friends in SN communication
- Runners World forum posts
 - Public group messages on the topic of marathon running. This data represents specialist forums for common-interest groups.
- Twitter posts
 - Public microblog broadcasts.
- YouTube comments:
 - Text comments posted to videos on the YouTube web site. This represents

Ortu et al. Dataset

(MSR 2016)



Primary emotions	Secondary emotions	Tertiary emotions
love	Affection	Compassion, Sentimentality, Liking, Caring, ...
	Lust/Sexual desire	Desire, Passion, Infatuation
	Longing	
Joy	Cheerfulness	Amusement, Enjoyment, Happiness, Satisfaction, ...
	Zest	Enthusiasm, Zeal, Excitement, Thrill, Exhilaration
	Contentment	Pleasure
	Optimism	Eagerness, Hope
	Pride	Triumph
	Enthrallment	Enthrallment, Rapture
Surprise	Surprise	Amazement, Astonishment
Anger	Irritability	Aggravation, Agitation, Annoyance, Grumpy, ...
	Exasperation	Frustration
	Rage	Outrage, Fury, Hostility, Bitter, Hatred, Dislike, ...
	Disgust	Revulsion, Contempt, Loathing
	Envy	Jealousy
	Torment	Torment
Sadness	Suffering	Agony, Anguish, Hurt
	Sadness	Depression, Despair, Unhappy, Grief, Melancholy, ...
	Disappointment	Dismay, Displeasure
	Shame	Guilt, Regret, Remorse
	Neglect	Embarrassment, Humiliation, Insecurity, Insult, ...
	Sympathy	Pity, Sympathy
Fear	Horror	Alarm, Shock, Fright, Horror, Panic, Hysteria, ...
	Nervousness	Suspense, Uneasiness, Worry, Distress, Dread, ...

Shaver et al.
framework of
emotions

4 coders

Emotion and Polarity: What Relation?



Emotion	Polarity
Love	Positive
Joy	Positive
Surprise	Ambiguous (might be Neutral but also Positive or Negative)
Anger	Negative
Sadness	Negative
Fear	Negative
No emotion	Neutral

Ortu et al. Dataset

(MSR 2016)



- Overall comments = 392
 - Majority Agreement on presence of emotions
- Mapping to Polarity Values (surprise were not considered)
 - Neutral: 74% (289)
 - Negative: 10% (39)
 - Positive: 16% (61)
 - Mixed: 1% (3)

Task 1



- **Use lexicons to score words as in:**
<http://sentiment.christopherpotts.net/lexicon/results/>
- <https://github.com/nnovielli/SACourseMaterial>



Task 2

- Run SentiStrength on the general and technical datasets
- Compare performance
 - Precision, Recall, F-measure, Accuracy
 - Is there any difference between the performance indicated by Accuracy and F-measure?
- Analyse misclassified cases
 - What are the main causes of misclassification?
 - How could they be addressed?
 - Do you think a supervised approach could perform better?