

Natural Language Processing for Cognitive Analysis of Emotions

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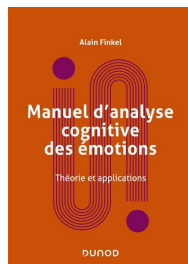


Summary

1. Cognitive Analysis of Emotions
2. Sentiment and emotion analysis
3. French dataset composed of autobiographical accounts of an emotional scene
4. Annotation scheme based on Cognitive Analysis of Emotion
5. Rule-based method and graph structure for automatic annotation

Cognitive Analysis of Emotions is a discrete emotion theory

- ▶ Cognitive Analysis of Emotions (CAE) is a method to help people improve their emotion management
- ▶ It studies how primary emotions (joy, anger, sadness, fear) appear in autobiographical accounts of emotional scenes



Finkel, april 2022

Alain Finkel. Manuel d'analyse cognitive des émotions: Théorie et applications. Paris: Dunod, 2022

Cognitive Analysis of Emotions is an appraisal theory

- ▶ An emotion arises when we evaluate a situation that invalidates or confirms our model of the world, made up of territories associated with our needs to be satisfied

Example: territories can be my body, my home, my professional values, my beliefs, my self-image, my time, etc.

- ▶ A coach trained in Cognitive Analysis aims to understand emotion causes before suggesting corrective actions to better handle situations

Cognitive Analysis of Emotions is based on the computational theory of mind

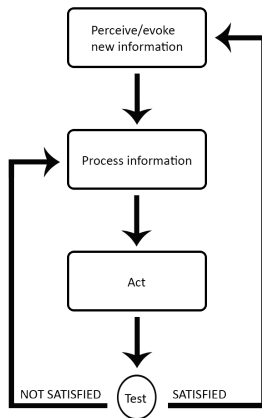


Figure: Simplified model of the mind as an emotional information processing system.

Autobiographical narratives categorized by the FERA grid

A fact is a statement about objects and actions in a scene. A fact can occur in the external world (perception) or in the internal world (evocation).

External facts	I'm in my room in England, I have a plate of tomatoes and hard-boiled eggs in front of me and I'm about to pour on it the new salad dressing I just bought. I pour, I taste, this dressing is infamous.
Internal facts	Feelings: All my muscles relax, I slump in my seat and stare into space. Thoughts: I see my old salad dressing that was so good, I see myself buying this new dressing and thinking "Let's try it".
Identify the emotions experienced and choose one	Sadness and anger. I choose anger.
Which territories are attacked (anger and fear), lost (sadness), found or conquered (joy) ?	My sense of taste attacked by this infamous dressing, my habits and the sense of security they provide were attacked as well as the knowledge of what is around me, the security of the tomato-egg salad dressing I am used to eating.

Limitations in Sentiment Analysis

Review of annotated text datasets for emotion analysis by Bostan and Klinger [3].

(Poria et al., 2020)

- ▶ Sentiment analysis in texts rarely considers psychological theories to really understand emotions and their causes.
- ▶ It is often simplified as a sentence-level classification problem.
- ▶ Annotated corpora are mostly small and limited to a few domains and languages.

New directions in Sentiment Analysis

(Poria et al., 2020)

- ▶ Aspect-level analysis
- ▶ Larger and richer datasets
- ▶ Different modalities
- ▶ Commonsense knowledge into models
- ▶ Sequential flow of sentiments
- ▶ Sentiment information for other NLP tasks
- ▶ Adaptation to multiple domains
- ▶ Bias reduction

Causality Extraction

Sentences	Causality forms
Financial stress is one of the main causes of divorce	Explicit et intra-sentential
Financial stress can speed divorce up.	Implicit et intra-sentential
You may hear that unfaithful can lead to divorce .	Explicit et inter-sentential
On the other hand, financial stress is another significant factor.	

Table: Forms of causal relationships (Yang, Han, and Poon, 2022).

NOT STIMULUS	STIMULUS
[She is happy]	[that things are going well.]

Table: Stimulus classification at the clause-level (Oberländer and Klinger, 2020).

O	O	O	B	I	I	I	I	O
She	is	happy	that	things	are	going	well	.

Table: Stimulus classification at the token-level (Oberländer and Klinger, 2020).

French is a poorly considered language for emotion analysis

Ying Chen et al. “Emotion Cause Detection with Linguistic Constructions”. In: *Proceedings of the 23rd International Conference on Computational Linguistics (Coling 2010)*. 2010

Rui Xia and Zixiang Ding. “Emotion-Cause Pair Extraction: A New Task to Emotion Analysis in Texts”. In: *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*. 2019

Laura Ana Maria Bostan, Evgeny Kim, and Roman Klinger. “GoodNewsEveryone: A Corpus of News Headlines Annotated with Emotions, Semantic Roles, and Reader Perception”. English. In: *Proceedings of the 12th Language Resources and Evaluation Conference*. Marseille, France: European Language Resources Association, May 2020, pp. 1554–1566

Patrick Paroubek et al. “DEFT2018 : Information Retrieval and Sentiment Analysis in Tweets about Public Transportation in Île de France Region”. French. In: *Actes de la Conférence TALN. Volume 2 - Démonstrations, articles des Rencontres Jeunes Chercheurs, ateliers DeFT*. Rennes, France: ATALA, May 2018, pp. 219–230

Aline Étienne, Delphine Battistelli, and Gwénoélé Lecorvé. “Expressing emotions in texts for children: constitution of an annotated corpus”. French. In: *Traitement Automatique des Langues Naturelles (TALN, 27e édition)*. Nancy, France: ATALA et AFCP, June 2020, pp. 205–212

French dataset composed of autobiographical accounts of an emotional scene

888 grids (87% single emotion, 12% two emotions)

Emotion distribution: 48% anger, 31% fear, 12% sadness and 10% joy

category	answer
EXTERNAL FACT	I am in the office, alone, it is Monday and...
INTERNAL FACT (FEELINGS)	I have a tightness in my chest...
INTERNAL FACT (THINKING)	Every time I think about this situation and...
FACT CHECKING	Context: factually expressed...
EMOTION IDENTIFICATION	Fear
TERRITORY	The attacked territory is my territory of...
TERRITORY CHECKING	It is indeed my territory, the attack is...
CONTRIBUTION OF THE ANALYSIS	Nothing, because I am waiting and...
INTERNAL ACTION	The emotion is not diminished in the sense that...
EXTERNAL ACTION	The only way to stop the attack is to flee...

Table: A grid containing FERA categories and their corresponding answers.

Emotion classification based on emotion components

Emotion classes to predict : joy, anger, fear and sadness

category	model	precision	support	F1 score
EXTERNAL FACT	LR	0.633 ± 0.012	0.614 ± 0.013	0.59 ± 0.021
EXTERNAL FACT	RF	0.619 ± 0.026	0.618 ± 0.03	0.574 ± 0.034
EXTERNAL FACT	SVC	0.663 ± 0.065	0.597 ± 0.029	0.545 ± 0.042
THINKING	LR	0.674 ± 0.068	0.677 ± 0.04	0.657 ± 0.046
THINKING	RF	0.702 ± 0.045	0.638 ± 0.038	0.594 ± 0.035
THINKING	SVC	0.705 ± 0.058	0.663 ± 0.042	0.631 ± 0.036
FEELINGS	LR	0.749 ± 0.026	0.738 ± 0.028	0.736 ± 0.024
FEELINGS	RF	0.756 ± 0.042	0.721 ± 0.035	0.705 ± 0.034
FEELINGS	SVC	0.737 ± 0.041	0.705 ± 0.033	0.684 ± 0.03

Table: Scores obtained from answers of the EXTERNAL FACT, THINKING and FEELINGS categories to predict emotions. LR = Logistic Regression, RF = Random Forest, SVC = Support Vector Classifier.

Feature analysis reveals the physiology of emotions

y='colère' top features		y='Joie' top features		y='peur' top features		y='tristesse' top features	
Weight ²	Feature	Weight ²	Feature	Weight ²	Feature	Weight ²	Feature
+1.627	chaleur	+3.485	sourire	+1.340	ventre	+1.554	triste
+1.346	dents	+1.541	joie	+1.291	cœur	+1.409	poids
+1.285	bras	+1.207	rire	+1.154	moites	+1.332	lourd
+0.962	sourcils	+1.156	souris	+1.110	jambes	+1.165	réchauffement
+0.933	mâchoire	+1.105	muscles	+0.916	froides	+1.146	yeux
+0.907	besoin	+1.088	agréable	+0.806	coeur	+1.130	larme
+0.895	colère	+1.036	détente	+0.780	ressenti	+1.097	pleurer
+0.808	poings	+1.023	content	+0.713	oppression	+1.052	larmes
+0.801	augmentation	+0.999	détendue	+0.686	ressentis	+1.036	pincement
+0.783	mains	+0.990	duvet	+0.634	peur	+1.035	soupirs
+0.779	visage	+0.957	beaucoup	+0.631	fort	+1.032	déglutition
+0.743	serre	+0.850	souriais	+0.611	tombent	+1.027	niveau
+0.732	crispé	+0.822	trépigne	+0.610	noue	+0.978	émotion
+0.690	mâchoires	+0.821	lever	+0.604	panique	+0.912	rien
+0.654	bouger	+0.811	relâchement	+0.596	tremblements	+0.908	sol
+0.637	enervement	+0.810	grande	+0.560	stress	+0.861	pointe
+0.627	pression	+0.776	profonde	+0.534	vite	+0.854	fatigué
+0.606	agite	+0.764	profondément	+0.530	tachycardie	+0.829	regardant
+0.602	moment	+0.749	détendu	+0.524	tremblent	+0.826	picotant
+0.588	aucun	+0.741	pouffe	+0.522	sueurs	+0.826	douloureuse
+0.577	température	+0.741	euphorique	+0.510	coupé	+0.820	lourde
+0.576	crispée	+0.741	facilement	+0.508	rapides	+0.804	tristesse
+0.565	serré	+0.689	légèreté	+0.499	accélération	+0.802	perte
+0.524	voix	+0.688	accélérent	+0.491	tremble	+0.791	explose
+0.514	fatigue	+0.679	pétitement	+0.481	frissons	+0.791	sanglot
+0.503	froncés	+0.629	chaude	+0.455	malaise	+0.777	corps
+0.490	serrent	+0.629	bonheur	+0.447	resserre	+0.763	manque
+0.467	fortement	+0.629	papillons	+0.447	nœud	+0.757	sternum
+0.462	serrées	+0.621	agréable	+0.446	bougent	+0.750	épaules
+0.457	monte	+0.621	reguliere	+0.445	vocales	+0.733	tête
+0.443	poing	+0.613	parlai	+0.444	coup	+0.723	gorge
+0.436	contractés	+0.607	gestes	+0.420	ordinateur	+0.713	œil
+0.434	crispation	+0.587	sensation	+0.415	seconde	+0.710	fragilité
+0.416	hausse	+0.583	calme	+0.410	bouffée	+0.691	plomb
+0.412	serrés	+0.557	vite	+0.410	souffle	+0.691	chape
+0.394	cherche	+0.550	douloureux	+0.408	sèche	+0.677	noué
+0.382	crispe	+0.545	technologie	+0.406	court	+0.675	tranquille
+0.380	énervé	+0.545	fête	+0.404	creux	+0.672	faible

Annotation scheme for Aspect-Based Emotion Analysis

(Campagnano, Conia, and Navigli, 2022)

- ▶ CUE : a marker indicating the presence of an emotion
- ▶ EXPERIENCER : the author who feels an emotion
- ▶ TARGET : an entity or a person targeted by an emotion
- ▶ CAUSE : an event that triggers an emotion

Example: “Gustave loves carnivorous plants because they are beautiful”, Gustave (EXPERIENCER) exposes his love (CUE) towards carnivorous plants (TARGET) because they are beautiful (CAUSE).

Extended annotation scheme to better understand emotion causes

- ▶ **TERRITORY** : corresponding to the notion of territory in CAE
- ▶ **ATTACK** : expressions related to the act of attacking or being attacked
- ▶ **ATTACKER** : an entity that attacks a **TERRITORY**

Example: “My skills are attacked by Marc”, “My skills” are a **TERRITORY** related to the author’s professional values and competent self-image attacked by the **ATTACKER** “Marc”.

Rule-based method to automatically identify emotions and their semantic roles

Manual creation of rules with:

- ▶ linguistic features (dependency parsing, co-reference resolution and part-of-speech tagging with SpaCy¹).
- ▶ lexical database (WordNet [10] and WOLF [16]).
- ▶ semantic features (sentiment and emotion lexicons [1] [11]).

Example: TERRITORY is found if it is the subject of an ATTACK in passive voice: “**My skills** are attacked by Marc”.

(Ray and Chakrabarti, 2022)

(Li et al., 2021)

¹<https://spacy.io>

Graph structure

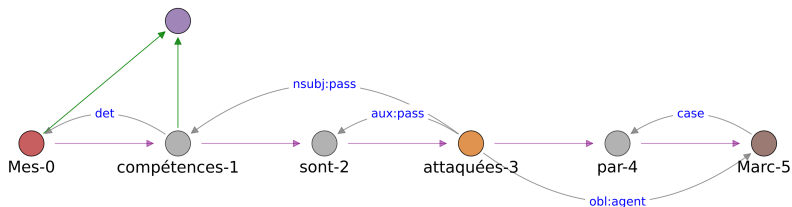


Figure: Visualization of the French sentence: "*Mes compétences sont attaquées par Marc*" (translated "My skills are attacked by Marc"). **Edge colors** indicate different types of relations. **Node colors** indicate semantic roles.

(Yan et al., 2021)

(Marcheggiani and Titov, 2017)

Conclusion

- ▶ Fine-grained analysis of an emotion and its semantic roles at the aspect-level
- ▶ New annotation scheme based on Cognitive Analysis of Emotion
- ▶ New French dataset composed of autobiographical accounts of an emotional scene
- ▶ Rule-based method and graph structure for automatic annotation

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