Universität Hamburg
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FROM UNSUPERVISED INDUCTION OF LINGUISTIC STRUCTURES FROM TEXT TOWARDS APPLICATIONS IN DEEP LEARNING

Induction of semantic frames

FrameNet: frame "Kidnapping"

Definition:

The words in this frame describe situations in which a Perpetrator carries off and holds the Victim against his or her will by force.

Two men KIDNAPPED a Millwall soccer club employee, police said last night.

Not even the ABDUCTION of his children by Captain Hook and his scurvy sidekick, Smee, can shake Peter's scepticism.

FEs:

Core:

Perpetrator [Perp]
Semantic Type: Sentient

The Perpetrator is the person (or other agent) who carries off and holds the Victim against his or her will.

Victim [Vict]
Semantic Type: Sentient
Non-Core:

The Victim is the person who is carried off and held against his/her will.

Co-participant [Co-p]

An additional abductee taken along with the Victim.
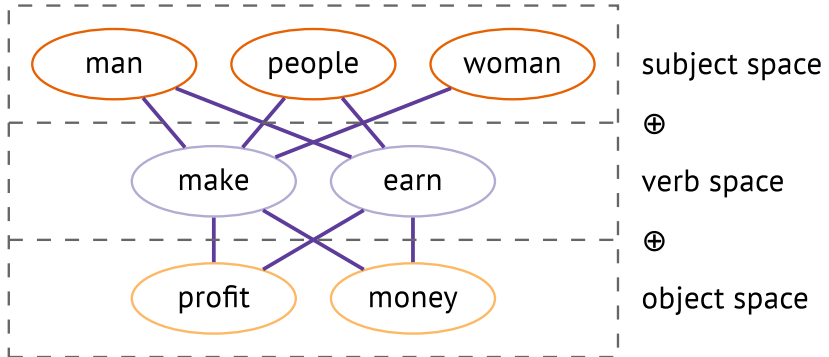She was ABDUCTED with her brother.

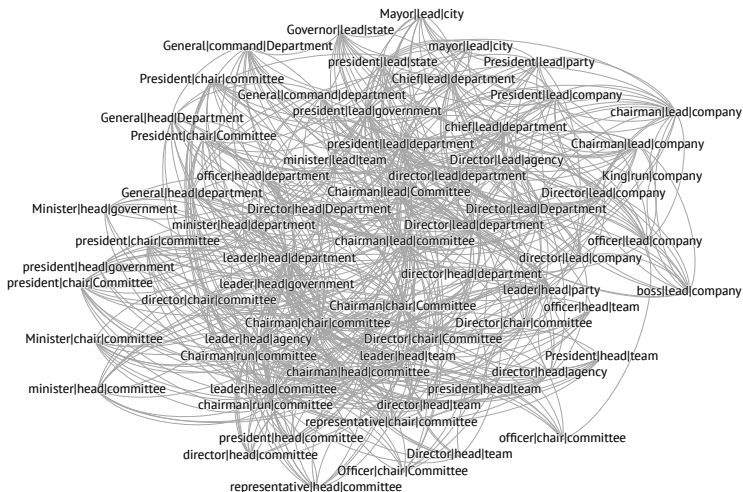# Frame induction as a triclustering

ACL'2018 [Ustalov et al., 2018]

Example of a LU tricluster corresponding to the "Kidnapping" frame from FrameNet.

FrameNet	Role	Lexical Units (LU)
Perpetrator	Subject	kidnapper, alien, militant
FEE	Verb	snatch, kidnap, abduct
Victim	Object	son, people, soldier, child

SVO triple elements

subject space

$\oplus$

verb space

$\oplus$

object space

An SVO triple graph

Triframes frame induction

Require: an embedding model $v \in V \rightarrow \vec{v} \in \mathbb{R}^d$,
Require: a set of SVO triples $T \subseteq V^3$,
Require: the number of nearest neighbors $k \in \mathbb{N}$,
Require: a graph clustering algorithm CLUSTER.

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Triframes frame induction

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Require: a graph clustering algorithm **CLUSTER**.
Ensure: a set of triframes F.

$\quad S \leftarrow \{t \to \vec{t} \in \mathbb{R}^{3d} : t \in T\}$
$\quad E \leftarrow \{(t, t') \in T^2 : t' \in \mathrm{NN}_k^S(\vec{t}), t \neq t'\}$
$\quad F \leftarrow \emptyset$
$\quad$ **for all** $C \in$ **CLUSTER**(T, E) **do**
$\quad\quad f_s \leftarrow \{s \in V : (s, v, o) \in C\}$
$\quad\quad f_v \leftarrow \{v \in V : (s, v, o) \in C\}$
$\quad\quad f_o \leftarrow \{o \in V : (s, v, o) \in C\}$
$\quad\quad F \leftarrow F \cup \{(f_s, f_v, f_o)\}$
$\quad$ **return** F

Example of an extracted frame

Frame # 848	
Subjects:	Company, firm, company
Verbs:	buy, supply, discharge, purchase, expect
Objects:	book, supply, house, land, share, company, grain, which, item, product, ticket, work, this, equipment, House, it, film, water, something, she, what, service, plant, time

Example of an extracted frame

Frame # 849	
Subjects:	student, scientist, we, pupil, member, company, man, nobody, you, they, US, group, it, people, Man, user, he
Verbs:	do, test, perform, execute, conduct
Objects:	experiment, test

Example of an extracted frame

Frame # 3207	
Subjects:	people, we, they, you
Verbs:	feel, seek, look, search
Objects:	housing, inspiration, gold, witness, part-ner, accommodation, Partner

Evaluation datasets

Dataset	# instances	# unique	# clusters
FrameNet Triples	99,744	94,170	383
Poly. Verb Classes	246	110	62

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Quality Measures:

- ■ nmPU: normalized modified purity,
- ■ niPU: normalized inverse purity.

Results: comparison to state-of-art

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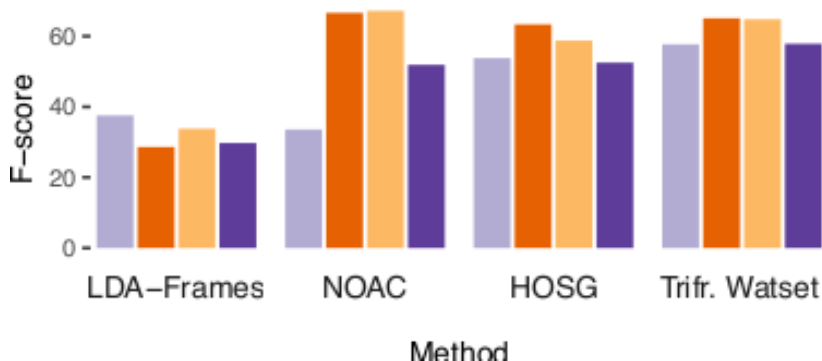
F_1-scores for ■ verbs, ■ subjects, ■ objects, ■ frames

Ustalov, D., Panchenko, A., Kutuzov, A., Biemann, C., &
Ponzetto, S. P. (2018).
Unsupervised semantic frame induction using triclustering.
arXiv preprint arXiv:1805.04715.