Tom.Powell@tno.nl

MAKING SENSE OF EVOLVING THREATS

A NOVEL AI APPROACH TO MONITOR VIOLENT ORGANISATIONS AND THEIR DEFINING CHARACTERISTICS FROM OPEN SOURCES

T. POWELL, A.M. STERNHEIM, I. TOLIOS, K. VAN DER ZWET, F. BOMHOF

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CONTENTS

AN AI APPROACH TO MONITORING CHARACTERISTICS OF VIOLENT ORGANISATIONS

TNO innovation for life

01. INTRODUCTION
WHAT IS THE PROBLEM?

CHALLENGES TO UNDERSTANDING VIOLENT ORGANISATIONS

- Increasing instability and fast pace of organisational evolution
- Hybrid conflict – sub-threshold hostilities, grey zone operations, proxy-warfare, use of cyberspace
- Digitalization and information overload

OPPORTUNITIES FOR UNDERSTANDING VIOLENT ORGANISATIONS

- Technological developments in AI and Data Science
- Wealth of structured qualitative knowledge about violent organisations
- Increasing knowledge of how to combine quantitative and qualitative insights

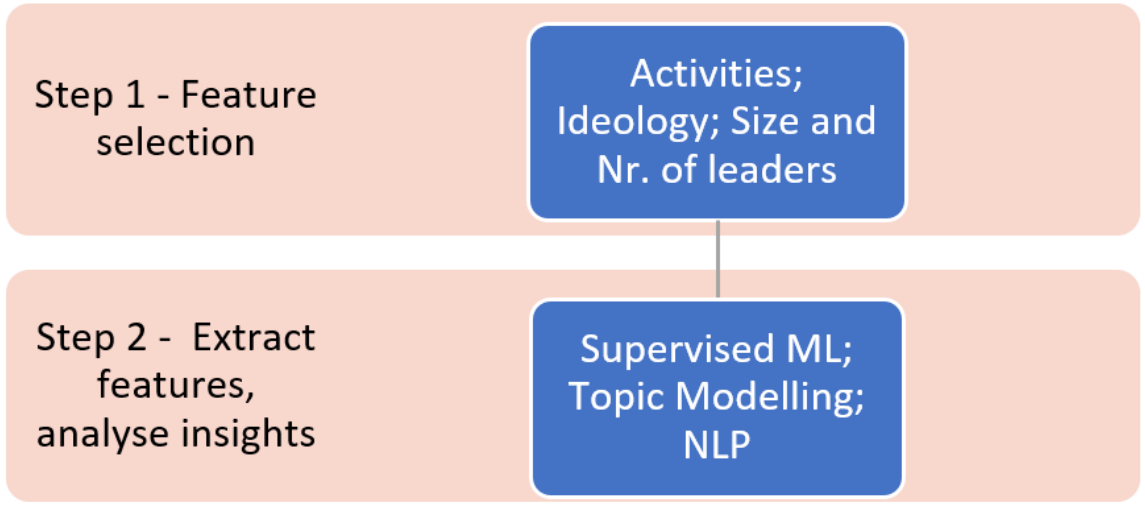
KEY CONTRIBUTION OF THIS PAPER

- Exploration: combining AI methods and qualitative knowledge to extract information about organisations from open sources
- A first proof-of-principle to improve decision support tools for intelligence analysts and commanders

01. INTRODUCTION
AIMS AND APPROACH

(Note: 'characteristic' and 'feature' used interchangeably)

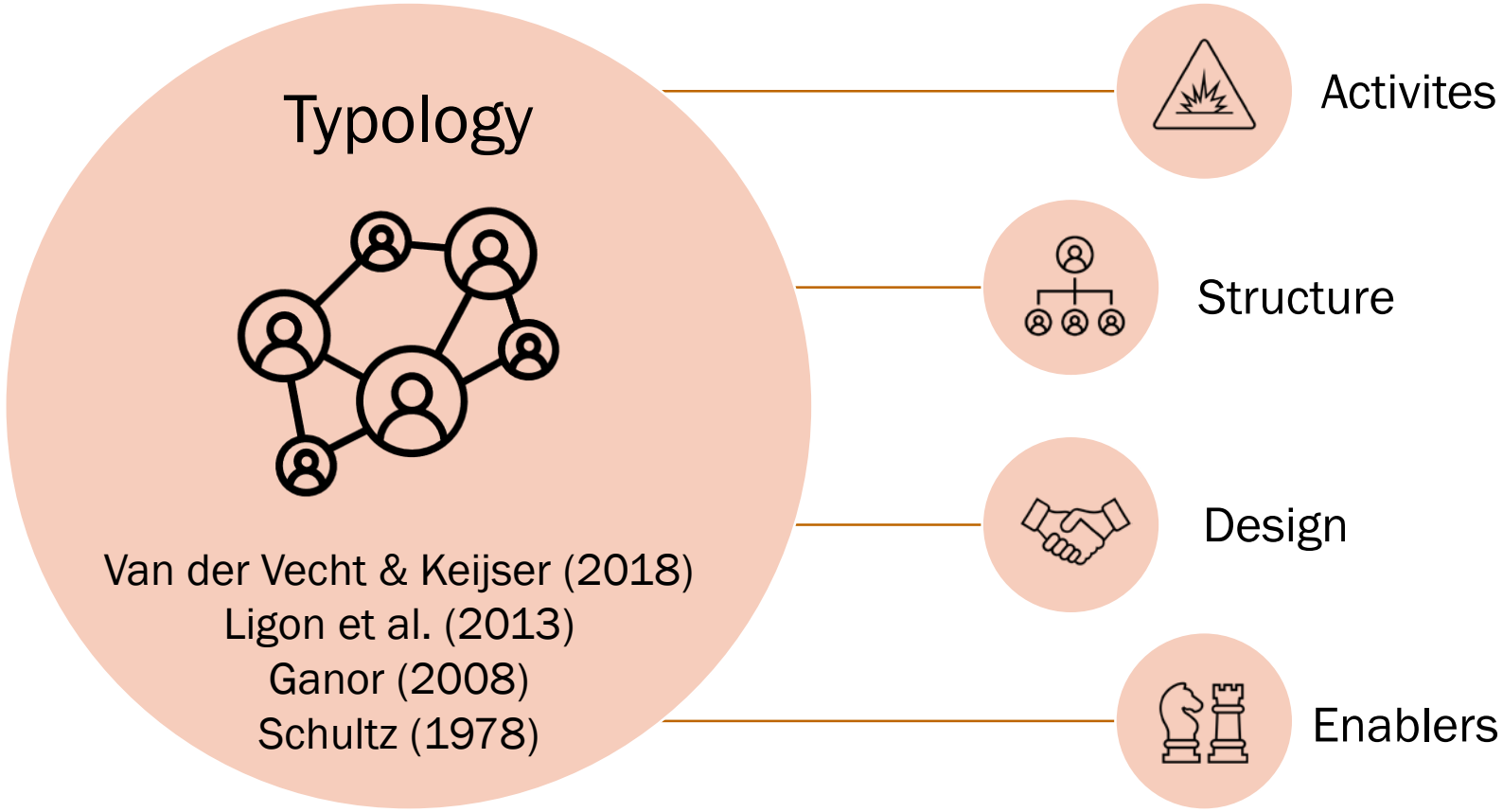
METHODOLOGICAL APPROACH



RESEARCH QUESTIONS

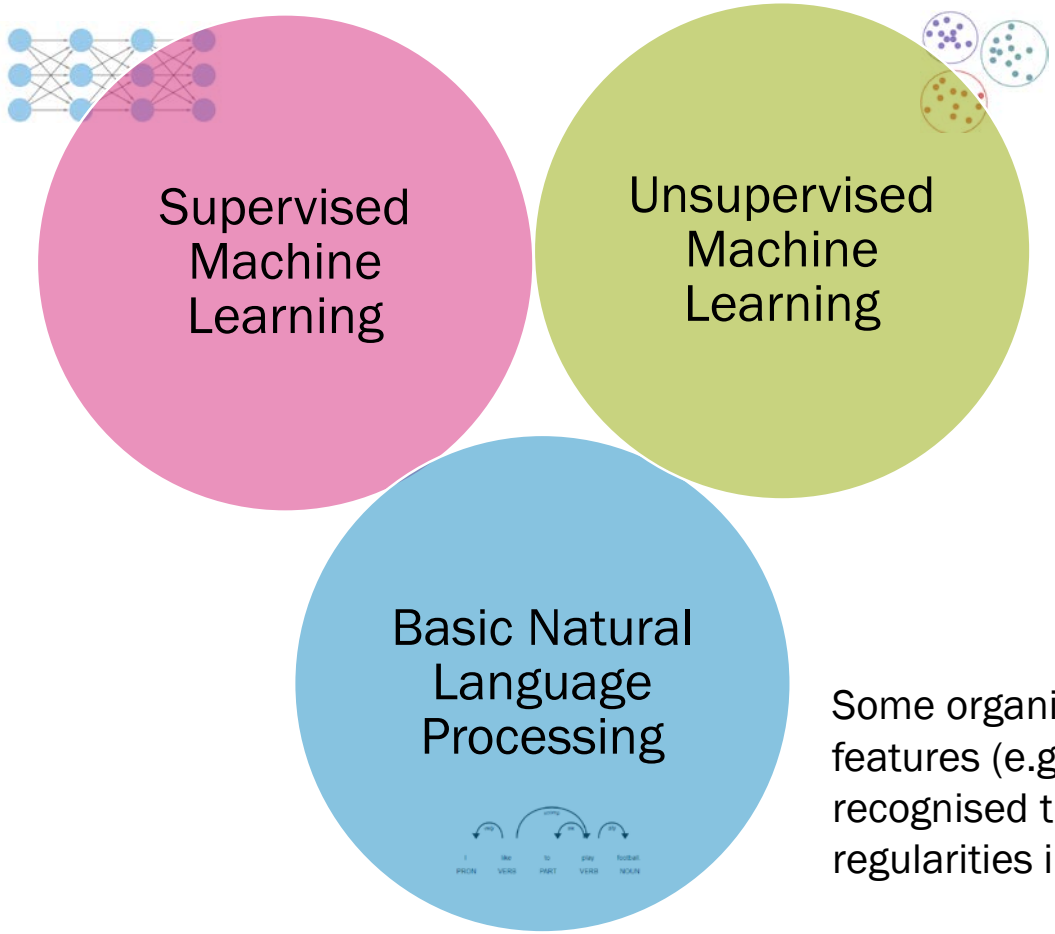
1. Which AI techniques are **well suited** to extracting important characteristics of violent organisations?
2. Are the automatically extracted characteristics an **accurate** representation of the knowledgebase from which they came?
3. To what extent can these AI techniques **generalise** to extract and monitor characteristics of violent organisations from a variety of other open source information (e.g., news articles, BBC monitoring, Janes)

02. LINKS TO EXISTING WORK
ORGANISATIONAL THEORY



02. LINKS TO EXISTING WORK
AUTOMATIC INFORMATION EXTRACTION METHODS

Risk of terrorist attacks (e.g. Mo et al., 2017) and categorisation of Modus Operandi (van Hensbergen, 2020)



Violent ideologies often reflect unique blends of existing/parent ideologies, which could be analysed with Topic Modelling

Some organisational features (e.g., size) may be recognised through regularities in text

02. LINKS TO EXISTING WORK
FEATURE SELECTION

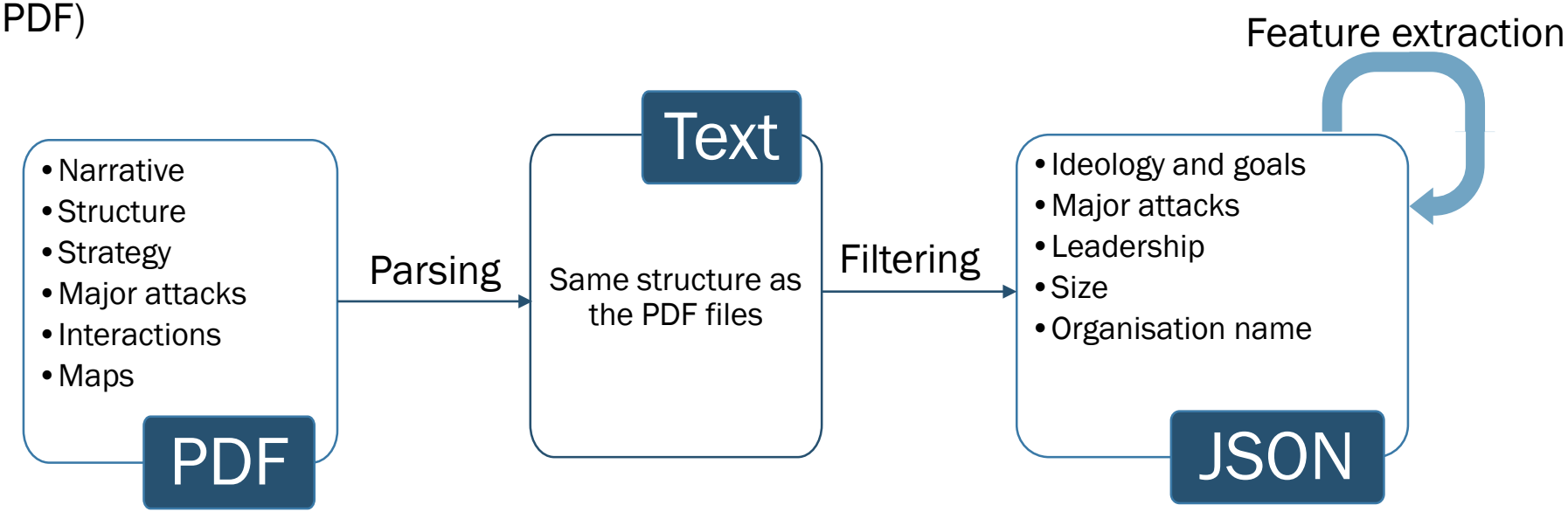
RQ1. Which AI techniques are well suited to extracting important characteristics of violent organisations?

Extraction method	Extracted feature
Supervised Machine Learning: Logistic regression model	Activities: Activity type
	Activities: Target type
Unsupervised Machine Learning: Topic modelling	Ideology
Basic Natural Language Processing: Regular expressions	Number of leaders
	Size
	Activities: Number of deaths
	Activities: Number of injuries

03. METHOD
DATA

MAKING USE OF AN EXISTING STRUCTURED KNOWLEDGE BASE

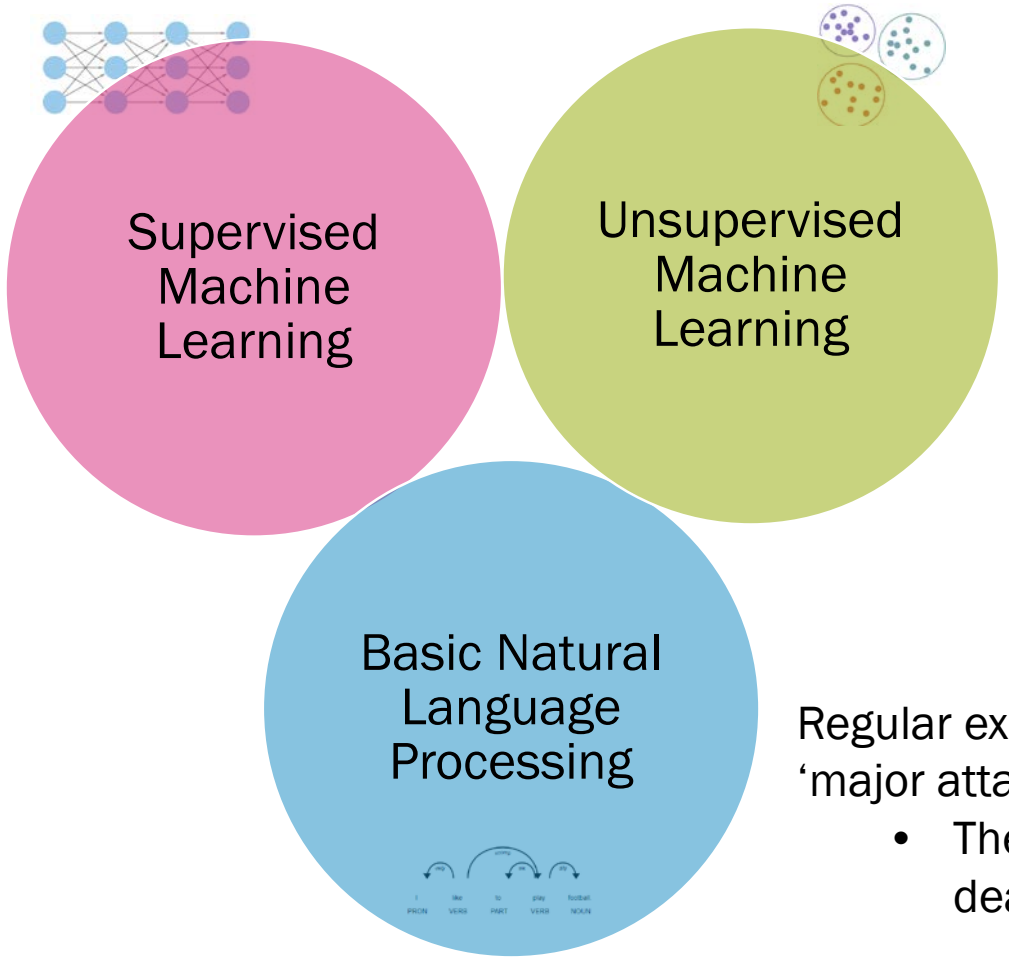
- Stanford Mapping Militants knowledge base
- Information about 86 militant organisations (summarized in PDF)



03. METHOD
FEATURE EXTRACTION

Logistic regression model (van Hensbergen, 2020)

- Trained on GTD for 9 activity types and 22 target types
- Applied to the MMD's 'major attacks' section



Topic modelling (LDA) applied to 'ideology and goals' section

- Each militant organisation is represented by a distribution of topics
- Hypothesis: the topics represent the different types of ideologies

Regular expressions were applied to the 'major attacks' section to extract:

- The size of a group; number of deaths and number of injured

04. RESULTS

SUPERVISED ML FOR ACTIVITIES

13 texts about Al- Qaeda checked as a basic performance evaluation.

Example →

Example text	Result		Valid (*explanation*)	
	Activity type	Target Type	Activity type	Target Type
November 15, 2003: Carried out over two days (November 15 and November 20, 2003), four truck bombs ran into 2 Jewish synagogues, a bank, and the British Consulate in Istanbul, Turkey. The bombing at the British Consulate may have been coordinated with U.S. President Bush's meeting with Tony Blair, which occurred the day of the second bombing (11/20/2003). (67 killed, 700+ wounded)	Bombing/Explosion	Government (Diplomatic)	Yes (*the paragraph mentions truck bombs*)	No (*the paragraph mentions multiple targets. The given label does not cove all of them*)
July 7, 2005: Four British men detonated 3 bombs on the London Underground and one on a double-decker bus during morning rush hour in London. Al Qaeda claimed the bombings, but there is no direct evidence that shows that AQ directed the attack. (56 killed, 770+ injured)	Bombing/Explosion	Transportation	Yes (*the paragraph mentions bombs*)	Yes (*the paragraph mentions the underground and busses, which are transportatio*)
October 2010: AQAP sent bombs through cargo mail, attempting to down planes over the U.S. The bombs were discovered before the planes left for the U.S. but had successfully passed through several cargo screening facilities in different countries. (No casualties)	Bombing/Explosion	Unknown	Yes (*the paragraph mentions bombs*)	No (*the paragraph mentions planes as the intended target*)

04. RESULTS
SUPERVISED ML FOR ACTIVITIES

- Performance:
  - 100% for activity type
  - 69% for target type
- Slightly better than van Hensbergen's (2020) external validation scores:
  - 89% for activity type
  - 67% for target type
- Full validation needed.

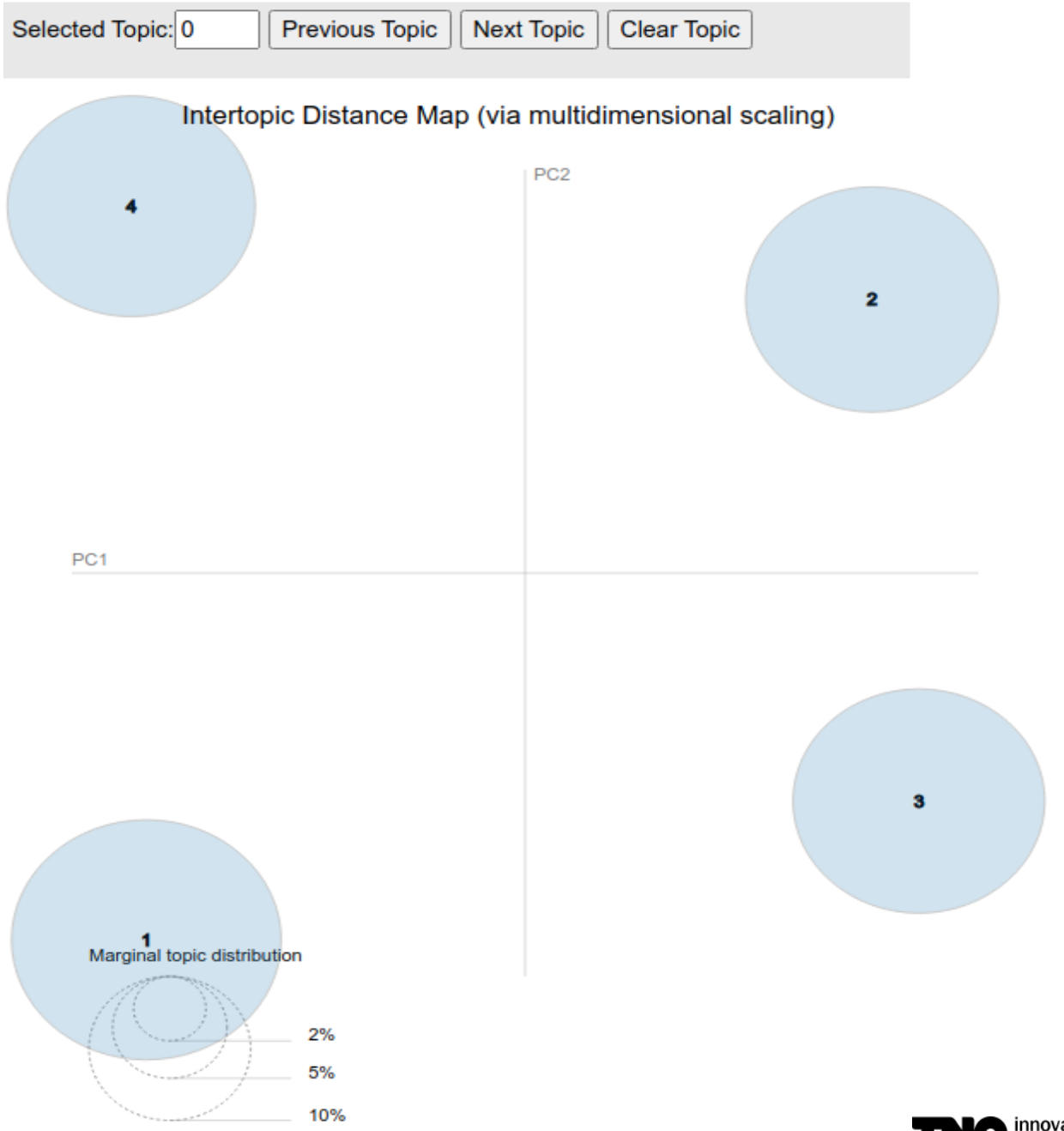
Activity type	Count	Valid (%)	Invalid (%)
Bombing/ explosion	9	100	0
Hijacking	1	100	0
Hostage taking (Kidnapping)	1	100	0
Assassination	1	100	0
Armed Assault	1	100	0
Total	**13**	**100**	**0**

Target type	Count	Valid (%)	Invalid (%)
Military	1	0	100
Maritime	1	100	0
Business	2	100	0
Government	2	0	100
Private Citizens & Property	2	100	0
Government (General)	1	100	0
Transportation	1	100	0
Airports & Aircraft	1	100	0
Unknown	1	0	100
Journalists & Media	1	100	0
Total	**13**	**69**	**31**

04. RESULTS

UNSUPERVISED ML FOR IDEOLOGY EXTRACTION

- LDA topic modelling method yields 4 topics, represented by the circles
- Distances between the circles reflect the level of similarity of the topics
- Topics are well spaced apart



04. RESULTS

UNSUPERVISED ML FOR IDEOLOGY EXTRACTION

- Salient terms and most central organisation per topic
- Ideologies based on topics not especially clear-cut
- Results influenced by inclusion of ‘goals’ in texts

Sunni Islamist ideology	White supremacy, anti-semitism	Shiite political militancy	Anti-government patriotism
Topic 1	**Topic 2**	**Topic 3**	**Topic 4**
Islamic Movement of Kurdistan	The Base	Asa'ib ahl al Haq	Oath Keepers
group	group	seek	government
goal	base	establish	order
ideology	white	attack	law
organization	anti	aim	state
influence	militant	force	people
islamic	overthrow	state	member
fight	global	region	include
regime	ideological	focus	american
support	promote	political	foreign
jihadist	violence	western	call
radical	belief	target	enemy
interpretation	advocate	oppose	movement
create	part	religious	leader
primary	affiliate	nationalist	early

04. RESULTS

BASIC NLP TO EXTRACT SIZE, #LEADERS, #DEATHS, #INJURED

	Number of death		Number of injured	
	Actual	Extracted	Actual	Extracted
(67 killed, 700+ wounded)	67	67	700+	700
(56 killed, 770+ injured)	56	56	770+	770
(No casualties)	0	NaN	0	NaN

- **# deaths and # injured:** Qualitative evaluation of 13 paragraphs from the 'major events' section (sample shown above)
- **Size and # leaders:** Tested on Al Qaeda text: correct size (32,000-44,000 in 2018) and #leaders (7)
- Overall 100% accuracy

04. DISCUSSION & CONCLUSION
COMBINING AI METHODS TO IMPROVE DECISION SUPPORT

RESEARCH QUESTIONS

- **RQ1: Feature selection**: Specific AI methods are suited to extract violent organisations characteristics
- **RQ2: Accuracy of Feature Extraction**: (a) Supervised ML for activity extraction is reasonably accurate;

(b) Basic NLP was highly accurate for extraction of size, number of leaders, and number of death and injured

(c) Topic modelling for ideology extraction is not immediately clear with subjective interpretation needed.

- **RQ3: Generalisability to other sources**: (a) Reasonable generalizability for Supervised ML for activity extraction;

(b) Topic modelling for ideology appears to be dependent on the input text;

(c) Basic NLP methods are quite dependent on structure of input text.

04. DISCUSSION & CONCLUSION
COMBINING AI METHODS TO IMPROVE DECISION SUPPORT

CONCLUSION

- Different AI methods can be combined to extract meaningful insights about violent organisations
- Automated tools for decision support from open source intelligence analysis
- Proof-of-principle: improvement and further development needed

FUTURE RESEARCH

- Extracted features can be summarized in a dashboard (in a ‘live IPOE’, Conklin et al., 2020)
- Imputation approach for missing values (e.g., word embeddings, knowledge graph)
- Emergent organisations: Identify loose collectives of individuals before they become formal organisations

Tom.Powell@tno.nl

THANK YOU FOR YOUR TIME

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