

CEPOL 2022



**Real time network,  
text, and speaker  
analytics for  
combating  
organized crime**

**The ROXANNE platform for supporting Law  
Enforcement practitioners in criminal  
investigations by analysing multi-modal data**

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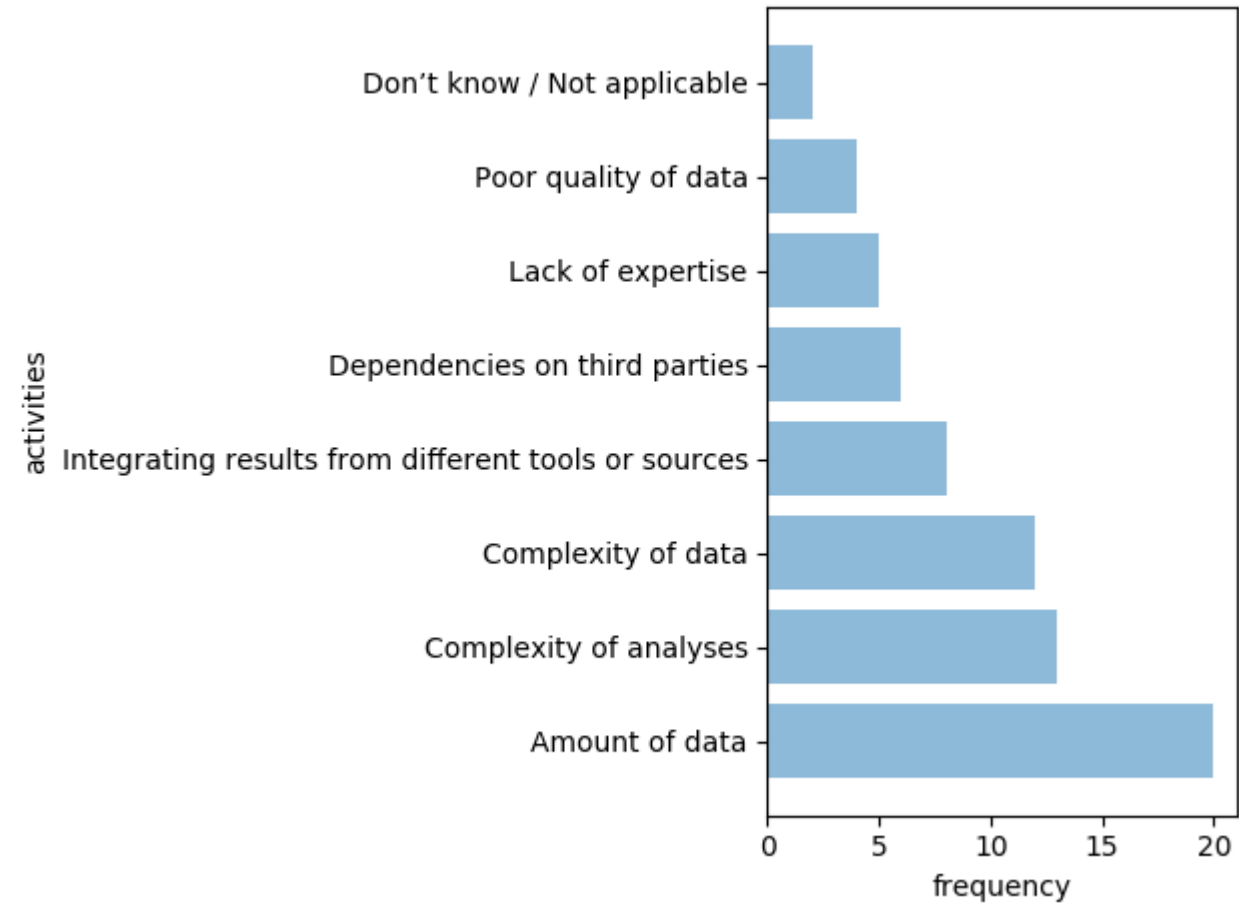
June 9<sup>th</sup> 2022



This project has received funding from the European Union's Horizon 2020 Work Programme for research and innovation 2018-2020, under grant agreement n°833635.

# LEAs' pain points

- ROXANNE run a survey on LEAs' requirements
- 121 responses were collected from 40 countries highlighting that amount of data to be processed and analysed is the main pain point



# Knowledge level related to ROXANNE learning topics

- ROXANNE also run a survey on LEAs' training requirements
- 31 responses were collected from 8 European countries

Only ~10% of the participants have received some training on all 4 key ROXANNE technologies!

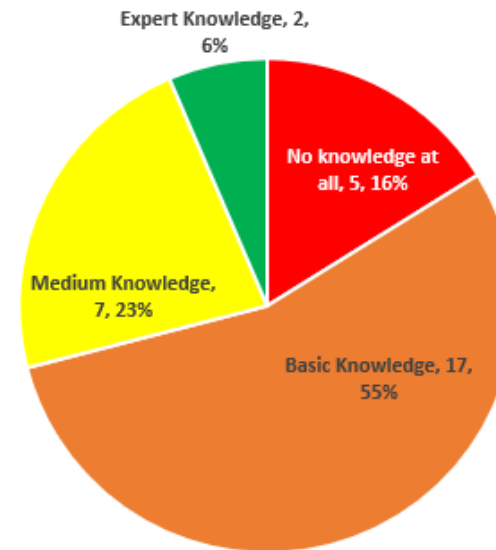
Speaker Identification (SID)



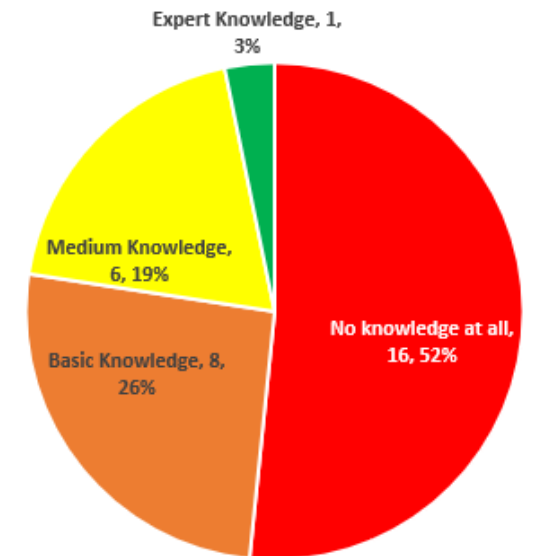
Natural Language Processing (NLP)



Video analysis (VA)



Privacy-enhanced criminal network analysis (NA)



# ROXANNE Objectives

LEA

Speed up investigation of large complex criminal cases (mixing SIM, cross-border, multiple-languages, use of nicknames, detection of leader, innocents, ...) and train LEAs on using state-of-the-art technologies

DEV

Platform to combine evidence extracted from multimodal sources with network analysis

RESEARCH

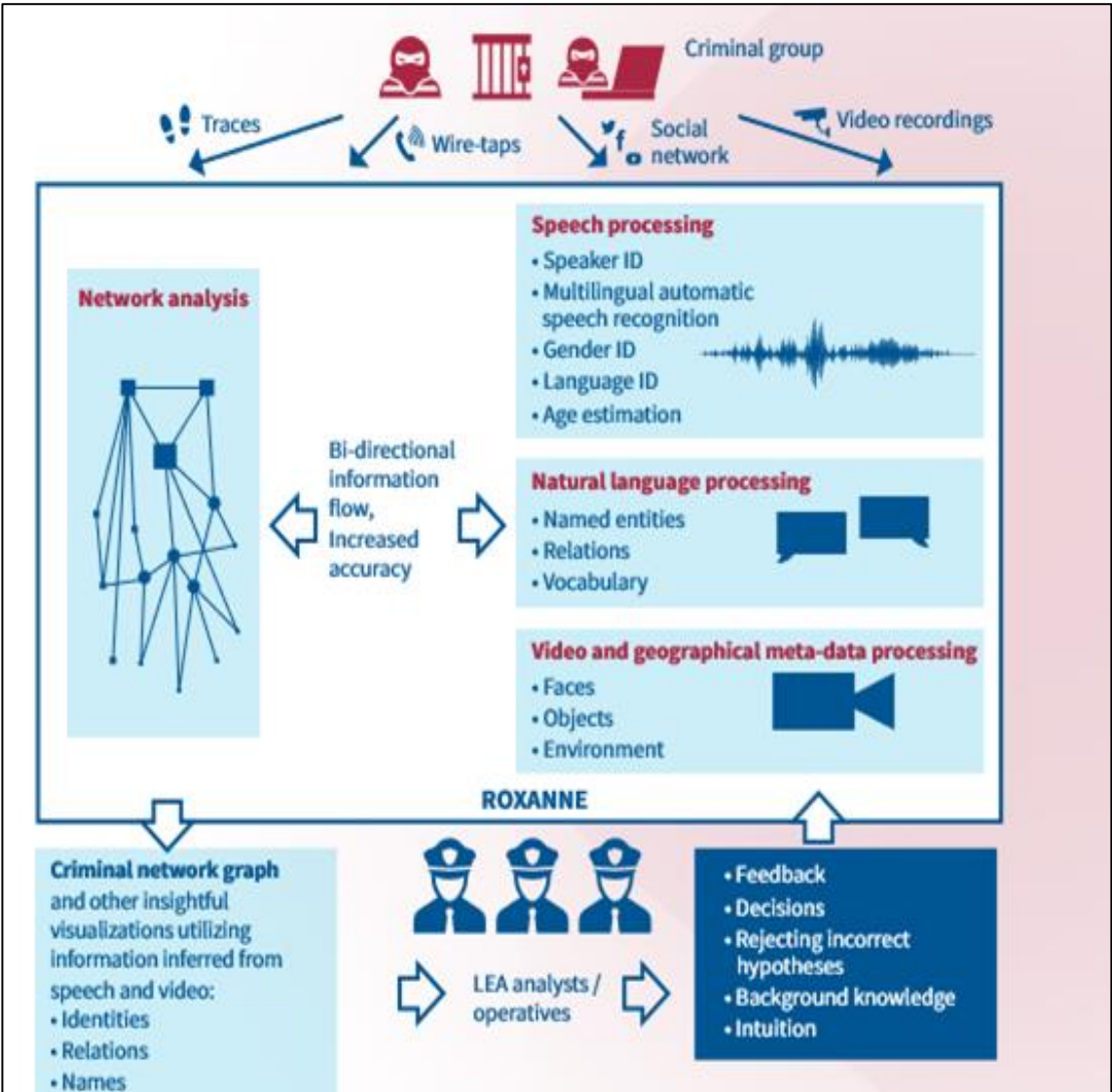
Bi-modal interaction between processing technologies and network analysis

ETHICAL

Implementing an ethics-by-design and privacy-by-design approach



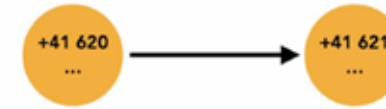
# ROXANNE Overview



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# Speaker Verification & Network Analysis

A wiretapped call



Voiceprint repository



New wiretapped call



Speaker verification process



Updated Voiceprint repository



Network Analysis



# The ROXANNE synthetic dataset

- ROXANNE prepared **a synthetic dataset** of 200+ simulated wiretapped phone calls and related metadata (i.e., Call Details Records (CDR) info)
- The screenplay involves three drug dealing cases
  - **A drug distribution case in Prague universities**
    - The police has wiretapped the two mobile phones of Krystof, as well as some of his partners.
  - **A drug distribution case in Prague city centre**
    - The police has wiretapped the mobile phones of Alexo
  - **A drug lab**
    - The police has wiretapped the mobile phones of Tuan and Hoang
- The investigator uses the Autocrime platform in order to identify whether and how these suspects are connected.



ID: roxsdv1

-> audios : 243



**ROXANNE**

Choose Scenario

Default Dataset



open

Create New Case





# Training Platform

<https://roxanne.kemea-research.gr/>

ROXANNE

Dashboard

- Site home
- Calendar
- Private files
- My courses
- SLAGI

Recently accessed courses

- ROXANNE Forensics Visualisation Toolkit
- ROXANNE Automatic speech recognition
- ROXANNE Topic detection
- ROXANNE Network analysis
- ROXANNE Voice Biometry
- ROXANNE Named-Entity Recognition

Course overview

All (except removed from view)

- ROXANNE Automatic speech recognition (0% complete)
- ROXANNE Forensics Visualisation Toolkit (0% complete)
- ROXANNE Named-Entity Recognition (0% complete)
- ROXANNE Network analysis (0% complete)
- ROXANNE Topic detection (0% complete)
- ROXANNE Voice activity detection, diarization (0% complete)
- ROXANNE Voice Biometry (0% complete)

Timeline

No upcoming activities due

Private files

No files available

Manage private files...

Online users

1 online user (last 5 minutes)

Michael Skitsas

Latest badges

You have no badges to display

Calendar

September 2021

Mon	Tue	Wed	Thu	Fri	Sat	Sun
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Upcoming events

There are no upcoming events

Go to calendar...

You are logged in as Michael Skitsas (Log out)

Registration is  
via invitation only

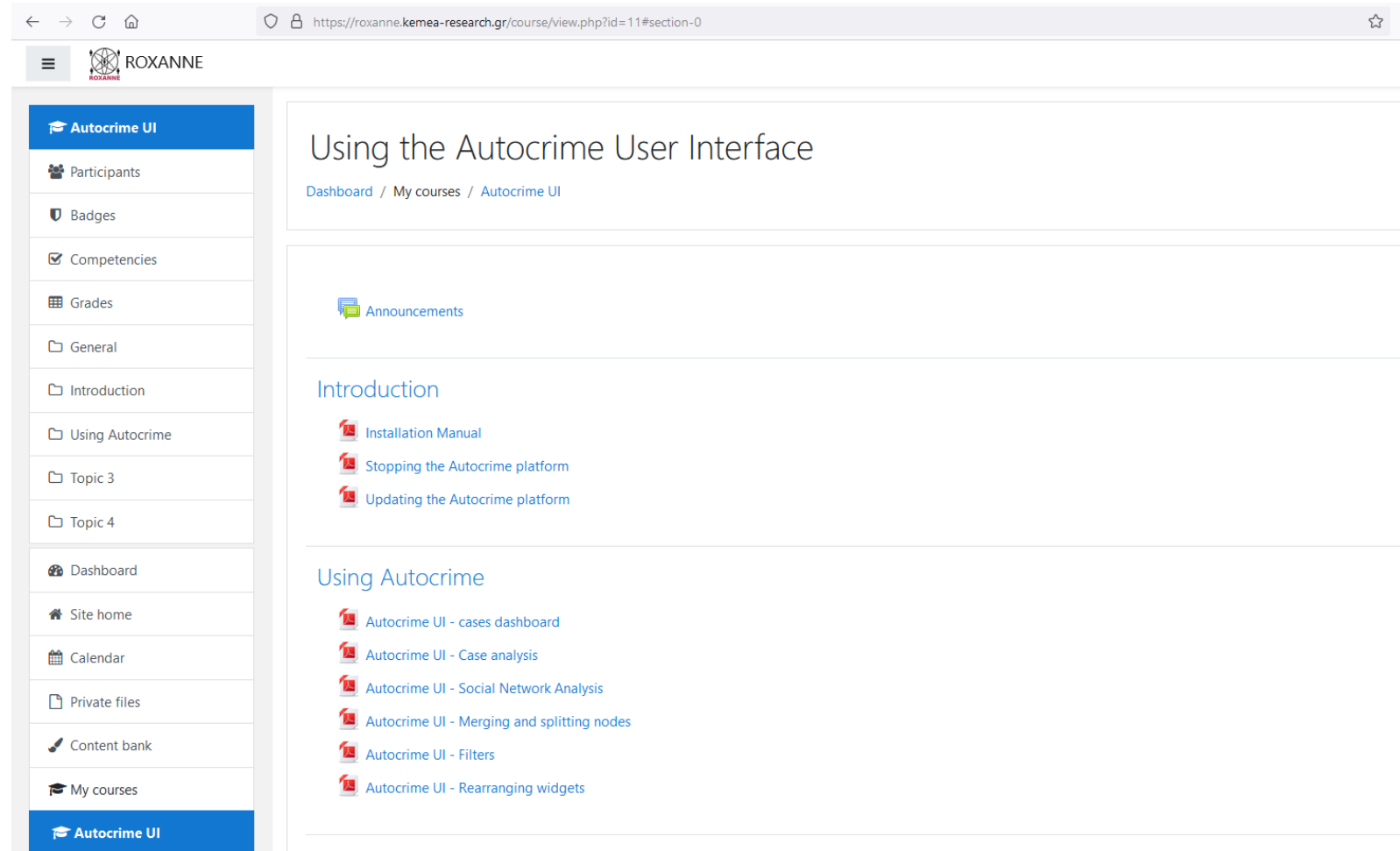
<https://docs.google.com/forms/d/e/1FAIpQLSc9kiBOvqmWV2YAqKnkwAIHQLGG49xQhMOFozKmcB5D-eMaQ/viewform>



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# List of courses

- Autocrime Platform
- Voice Activity Detection (VAD) and Speaker Diarization (DIAR)
- Speaker Identification (SID)
- Voiceprint Extraction
- Gender Identification
- Automatic Speech Recognition
- Topic Detection
- Named Entity Recognition
- Mention Network
- Network Analysis



The screenshot shows a web browser window with the URL <https://roxanne.kemea-research.gr/course/view.php?id=11#section-0>. The page header includes the ROXANNE logo and navigation icons. A left sidebar menu lists various course components: Autocrime UI (selected), Participants, Badges, Competencies, Grades, General, Introduction, Using Autocrime, Topic 3, and Topic 4. Below these are utility links: Dashboard, Site home, Calendar, Private files, Content bank, My courses, and Autocrime UI. The main content area displays the title 'Using the Autocrime User Interface' and a breadcrumb trail: Dashboard / My courses / Autocrime UI. There is an 'Announcements' section and two main content sections: 'Introduction' with links for 'Installation Manual', 'Stopping the Autocrime platform', and 'Updating the Autocrime platform'; and 'Using Autocrime' with links for 'Autocrime UI - cases dashboard', 'Autocrime UI - Case analysis', 'Autocrime UI - Social Network Analysis', 'Autocrime UI - Merging and splitting nodes', 'Autocrime UI - Filters', and 'Autocrime UI - Rearranging widgets'.



# Next Steps

- The Autocrime platform is currently being extended to support additional modalities (e.g., video) and export results to other known formats
- On Oct 6<sup>th</sup> 2022, the ROXANNE project will run the final field test in Lyon, France (INTERPOL premises)
  - Let us know if you are interested to participate on site
- On Jan 2023, the ROXANNE project shall release:
  - the ROXANNE platform **free of charge** to interested LEAs
  - the synthetic dataset to other researchers (expanded to also include videos and chat messages)



# ROXANNE Consortium - Partners



25 Partners across 16 Countries



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# Thank you!

Any questions?



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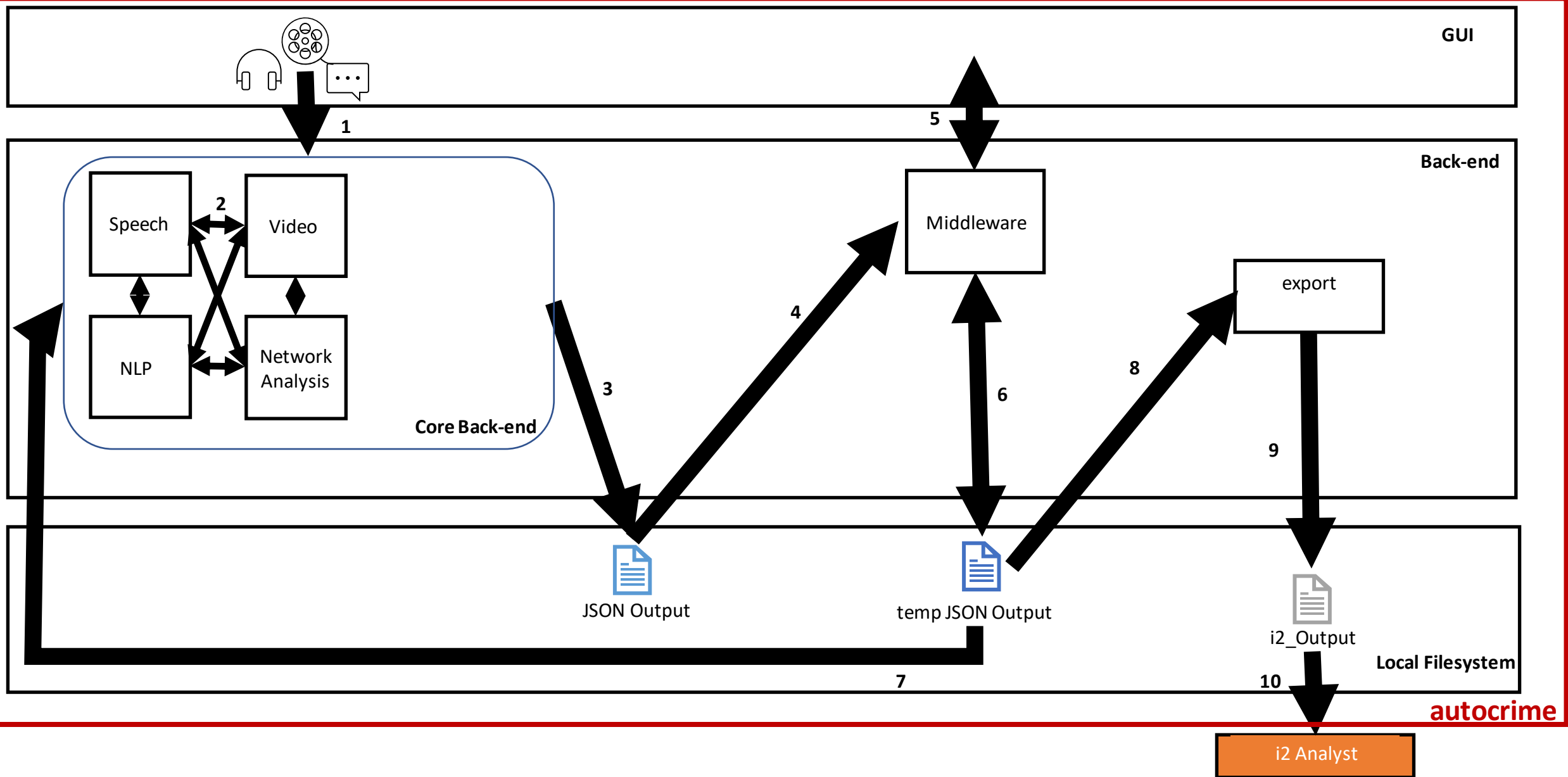
# Backup slides



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# Autocrime components and interactions



# Evaluation of Autocrime Technologies

Technology	Partner(s)	Method	Status	Performance
Speaker Diarization	BUT & Phonexia	Energy-based VAD + VBx	●	DER 5.91%
Speaker ID	BUT & Phonexia	ResNet architecture	●	99.95% speaker accuracy
Open set Speaker ID	BUT	Same as SID	●	90%
Gender ID	Idiap	GMM-based	●	66% accuracy
LID	Idiap	ECAPA-TDNN on Speechbrain	●	76.5% accuracy
ASR	Idiap	Wav2Vec 2.0 + LM, English	●	46.3% Word Error Rate
ASR	HENS	Hybrid TDNN AM + 3-gram LM, English	●	48% Word Error Rate
Topic	Idiap	Zero-shot	●	Not measured yet
NER	USAAR	BERT-based	●	Not measured yet
Mention network	USAAR	Custom co-reference analysis module	●	89% accuracy
Network analysis	LUH	Community Detection, Social Influence Analysis, Link Prediction and Node Embedding	●	Community Detection: F1-score 75% Link Prediction: 67.22% accuracy (Top-5)



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