EMPLOYING CROWDSOURCING IN A HIGHER EDUCATION COMPUTER SCIENCE COURSE

A case study

Eirini Kaldeli
Senior researcher at the
National Technical University of Athens

eritage

Contributors

- Contributors: Vassilis Lyberatos, Spyridon Kantarelis, Eirini Kaldeli, Spyros Bekiaris, Panagiotis Tzortzis, Orfeas Menis - Mastromichalakis, Giorgos Stamou

- Accepted in the 4th International Conference on Artificial Intelligence in Education Technology (AIET 2023)
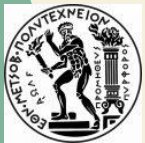
Case study overview

- Interdisciplinary orientation: Digital Technologies + Cultural Heritage + Citizen Science + Education

- How can digital crowdsourcing become part of a homework assignment involving higher education students of computer science?

- How can digital heritage collections be utilized in this context?

- What are the potential benefits for CS students and IT research?

- Students assume a dual role: citizens-contributors and scientists-researchers

citizen Heritage
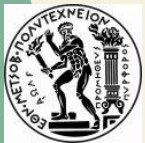
Homework assignment

- Informatics course on "Knowledge Systems and Technologies" at NTUA

- 98 fourth-year undergraduate students

- Participation in online campaign to enrich the metadata of music tracks collections

- Apply semantic web technologies to construct a knowledge graph, extract useful information, and make music tracks recommendations

- Openly available annotated dataset, which can be useful for machine learning models for music tagging

citizen Heritage
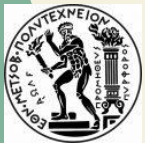
Research questions

- What were the educational benefits in line with the objectives of the computer science course?
    - understanding of structure and semantics of (meta-)data
    - processes and technologies for data management (enrichment, knowledge graph, queries)

- How was the participation experience perceived by students?
    - feelings and attitudes
    - user experience of digital technologies

Methodology

1

DATASET CURATION

Select and clean metadata from Europeana music collections (854 tracks selected)
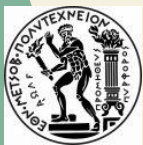
2

SETUP ENRICHMENT TASKS AND CROWDSOURCING CAMPAIGN

Add tags about "Emotion", "Genre", and "Instruments". Up-/downvote (peer-review). Free text comments.

3

BUILD AND QUERY A MUSIC KNOWLEDGE BASE

Link with Wikidata; Use NLP and sentiment intensity analysis; Build an ontology; Construct SPARQL queries that return similar tracks
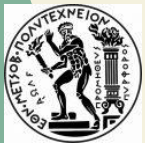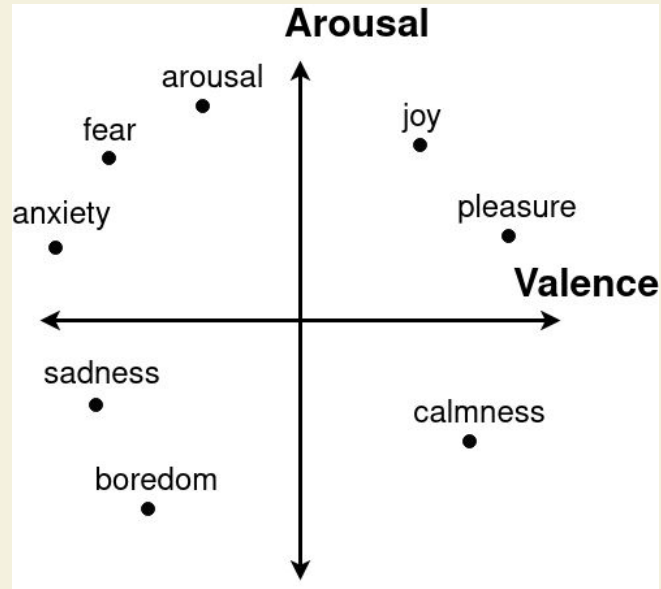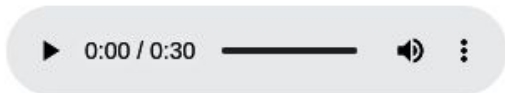
citizen Heritage

Methodology

SETUP OF ENRICHMENT TASKS AND CROWDSOURCING CAMPAIGN

Emotion tags in Russel circumplex model

CrowdHeritage

TAGS

FULLSCREEN ⤢

Try to identify which **Emotion** is triggered while listening to the music track. (up to 2 tags). Then specify the **Genre** you think the music track belongs to? (up to 2 tags). Finally, tell us which musical **Instruments** you hear on the music track? If you hear a full orchestra select the Orchestra tag. (no limit on tags)

Emotion

Pleasure	⬆	👍	12	0 👎
Arousal	⬆	👍	8	0 👎
Calmness	⬆	👍	6	0 👎
Sadness	⬆	👍	1	0 👎
Joy	⬆	👍	1	0 👎

Genre

Rock music	⬆
Jazz	

▶ 0:00 / 0:30 🔊 ⋮

CREATOR
Leali, Fausto

RIGHTS STATEMENT
OTHER LEGAL RESTRICTIONS

CONTENT PROVIDER
Internet Culturale / Biblioteca
Nazionale Braidense - Milano

peana

Campaign results

- 8399 added tags
- 834 free text comments
- 49351 up-votes and 495 down-votes
- 5147 tags after keeping only top-ranked based on votes

Genre 20.4%
Comment 13.0%
Instrument 31.9%
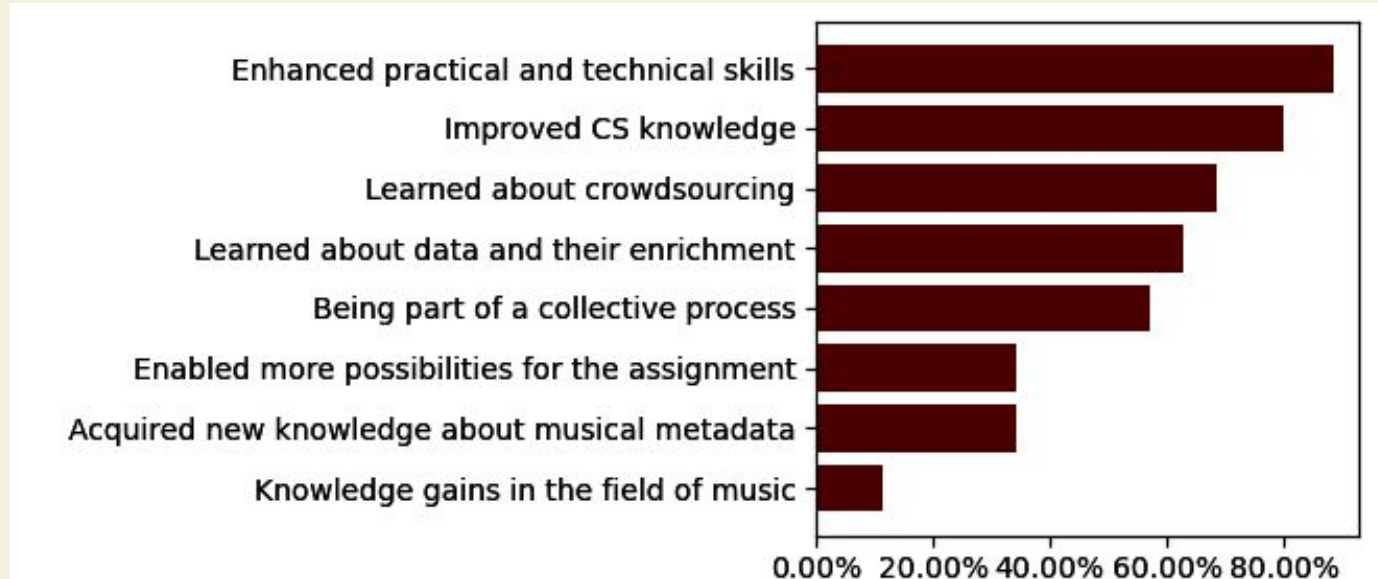Emotion 34.7%

citizen Heritage
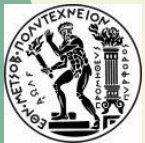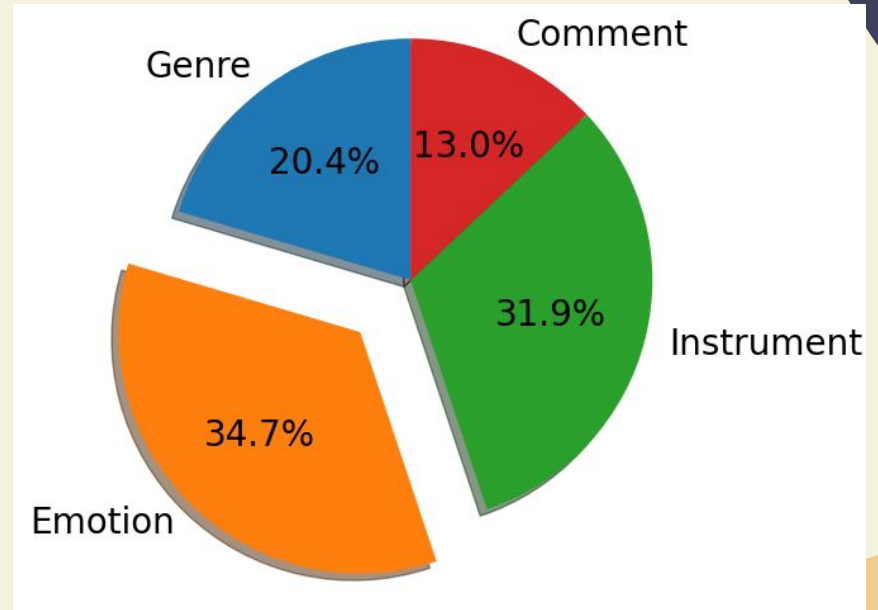
Evaluation by participants

- Online survey consisting of closed and open questions

- Completed by 35 students (5 females and 30 males)

- Understand how students perceived the crowdsourcing process as a part of their mini-project assignment

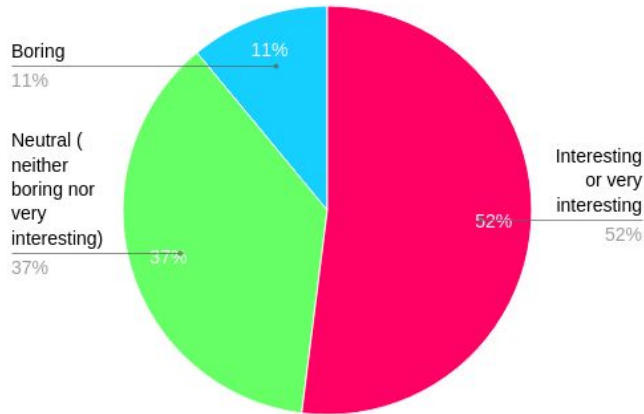- Collected useful feedback about the CrowdHeritage platform
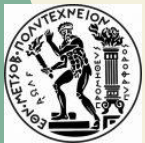
Evaluation Results: learning outcomes

Benefits mostly appreciated by students

Evaluation Results: engagement

Campaign participation experience

- Boring 11%
- Neutral (neither boring nor very interesting) 37%
- Interesting or very interesting 52%

- 46% found that certain tasks required music knowledge they lacked
- 35% perceived annotation tasks as too time-consuming (each students was encouraged to annotate 80 items)

- 11% stated knowledge gains in the field of music (e.g. learning about new songs, genres, instruments)
- 34% stated that they acquired new knowledge about cultural and musical metadata (e.g. their structure, properties)

Evaluation Results

Sentiment analysis of the 834 free text comments

Some conclusions

- Students mostly appreciated competences which advanced their computer science expertise (technical and methods skills)

- Feelings about engagement appear mixed:

  - 94% of students agreed or strongly agreed that the CrowdHeritage platform was very usable and user-friendly

  - Quite demanding goal

  - Certain tasks required quite advanced knowledge about music

  - Crowdsourced citizen science entails labor and the repetitive or mundane nature of tasks often understated

citizen Heritage
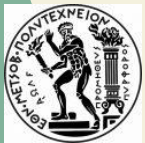
Open dataset

- Filtered resulting dataset can be valuable for the prototyping and evaluation of Music Information Retrieval models (for genre, instrument, and emotion recognition)

- 699 music tracks that have at least a 30-secs duration and are annotated wrt genre, emotion, and identified instruments

- Correlation between tags: most frequently observed pair tags reflect intuitive knowledge about music (e.g. Rock-Drums, Classical-Orchestra, Calmness-Instrumental) and are in accordance with prior findings
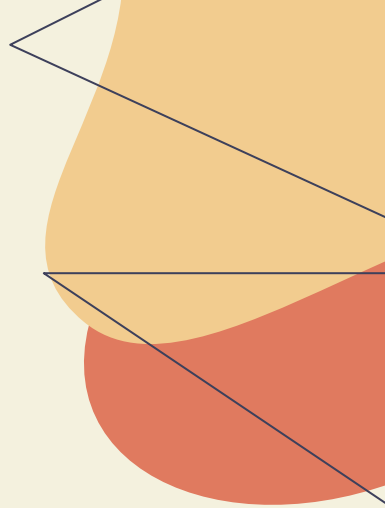
citizen Heritage
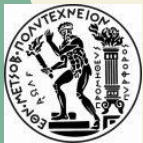
Recommendations

- The crowdsourcing setup should serve the objectives of the course and should be clearly explained to the students

- The crowdsourcing tasks should not be too cumbersome

- Emphasis should be given to crowdsourcing as a process and not just as a task in itself

- Particular attention should be paid to data curation and preparation

- It is of added-value if the results of crowdsourcing are made openly available and have an impact beyond the course
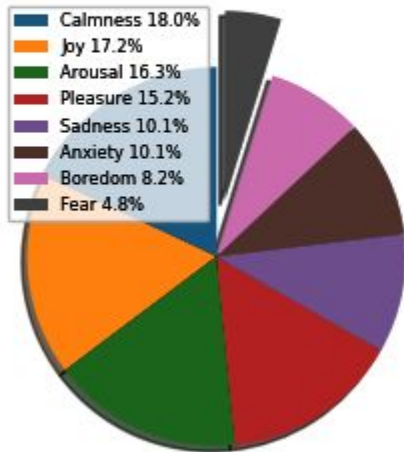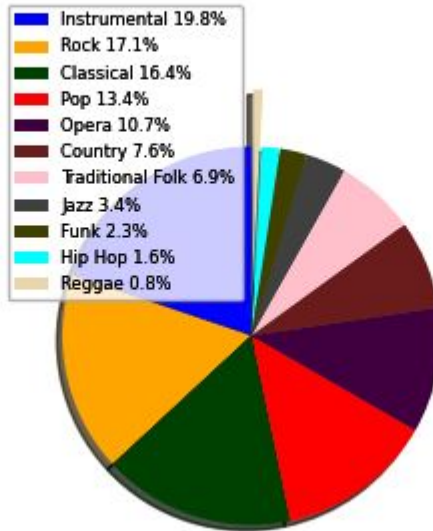
citizen Heritage
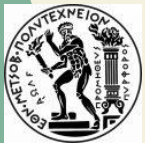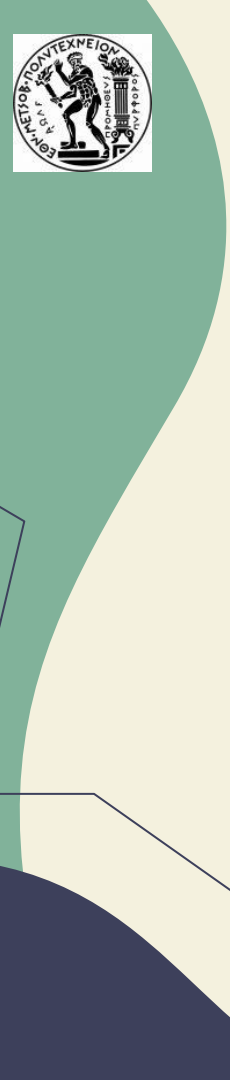
THANKS!

DO YOU HAVE ANY QUESTIONS?

citizen Heritage

Campaign Results

Annotation tags per metadata property

a) Emotion annotation tags

- Calmness 18.0%
- Joy 17.2%
- Arousal 16.3%
- Pleasure 15.2%
- Sadness 10.1%
- Anxiety 10.1%
- Boredom 8.2%
- Fear 4.8%

b) Genre annotation tags

- Instrumental 19.8%
- Rock 17.1%
- Classical 16.4%
- Pop 13.4%
- Opera 10.7%
- Country 7.6%
- Traditional Folk 6.9%
- Jazz 3.4%
- Funk 2.3%
- Hip Hop 1.6%
- Reggae 0.8%

c) Instrument annotation tags

- Drums 17.2%
- Orchestra 13.1%
- Bass 12.3%
- Electric Guitar 10.7%
- Acoustic Guitar 9.7%
- Violin 9.4%
- Piano 7.8%
- Synthesizer 6.8%
- Brass 5.1%
- Woodwind 3.9%
- Banjo 2.5%
- Harmonica 1.5%

Evaluation Results

Sentiment analysis of the 834 free text comments