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SPICE

Social cohesion, Participation, and Inclusion through Cultural Engagement

D3.8 Community recommender

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3	DMH	DESIGNMUSEON SAATIO - STIFTELSEN FOR DESIGNMUSEET SR	Finland
4	AAU	AALBORG UNIVERSITET	Denmark
5	OU	THE OPEN UNIVERSITY	United Kingdom
6	IMMA	IRISH MUSEUM OF MODERN ART COMPANY	Ireland
7	GVAM	GVAM GUIAS INTERACTIVAS SL	Spain
8	PG	PADAONE GAMES SL	Spain
9	UCM	UNIVERSIDAD COMPLUTENSE DE MADRID	Spain
10	UNITO	UNIVERSITA DEGLI STUDI DI TORINO	Italy
11	FTM	FONDAZIONE TORINO MUSEI	Italy
12	CELI	MAIZE SRL	Italy
13	UH	UNIVERSITY OF HAIFA	Israel
14	CNR	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy

Executive summary

D3.8 reports on the development of the social recommender in SPICE. Building on the case studies, the user model and community model data structures and reasoners were defined and implemented, as well as APIs for accessing the data in the linked data hub [LDH]; the user and community model data is used by the social recommender for considering what information to present to the visitor. The social recommender is triggered by the case study visitors' guide/system to suggest a content to the current visitor according to the scenario guidelines - given the user model, search for similar/different content provided by similar/different users in similar/different communities. The main challenge we faced during the development of the social recommender was the need to adapt to the evolving requirements of the case studies, as they continuously gained knowledge during the design and implementation of the case studies. This added uncertainty about specific requirements of case studies from the recommender had to be addressed during the 3rd year. Moreover, the unstable situations in the museum case studies due to the COVID-19 issues, triggered the need for some readjustments of the original case studies. Today, a generic recommender infrastructure was designed, implemented and demonstrated with data collected by several partners, including the Hecht, GAM and DMH case studies. The details of the technology are described in this document.

Document History

Version	Release date	Summary of changes	Author(s) -Institution
V0.1	11/04/2023	First draft	Tsvi Kuflik, Joel Lanir and Alan Wecker (UH),
V0.2	20.4.2023	2nd draft	Tsvi Kuflik and Alan Wecker (UH), Guillermo Diaz (UCM).
V0.3	23/4/2023	3rd draft	Alan Wecker (UH), Enrico Daga (OU).
V1.0	28/04/2023	Final version submitted to REA	UNIBO

Table of Contents

1. Introduction

WP3 Deliverable 3.8, the social recommender, focuses on using the technological infrastructure that is developed in WP3 (User Model, Semantic Analyser, Community Model) and providing content recommendation to individual visitors with the SPICE aim –to promote social cohesion– by allowing the users to explore and experience content that is similar or different to their point of view and produced by members of similar or different communities (to the community they belong to) –according to the systems' curator guidelines. Previous deliverables enabled reasoning about individuals, their characteristics and preferences, the explicit communities they identify themselves with and the implicit communities that evolve from analysing content contributed by these individuals. WP3 Deliverable 3.8, uses the user and community models for guiding the process of content recommendation to users. When activated by the museum system, the recommender searches the LDH for content to be presented to the user according to predefined guidelines.

D3.8 describes the design and development of the prototype social recommender. The document is organized as follows: It starts with an abstract description of the social recommender and its services. Following is a description of the internal and external links of WP3 and the role of the social recommender there. Finally, there are conclusions. An appendix includes detailed APIs, usage examples and code of the different services.

2. Social Recommender (SR)

Motivation and justification

Normally, recommender systems in general, and recommender systems for cultural heritage in particular, try to maximize the satisfaction of each individual choice by the user (Ricci et al. 2015). Alternatively, the recommender can be motivated by the goals of, not necessarily that of the end user, but rather by the goals of organizations trying to promote a certain agenda. In addition, in recent years a broader view of recommendation goals has been established such as diversity, and serendipity (Kotkov et al., 2020). In SPICE, we aim to apply novel recommendation techniques to advance additional goals of promoting social cohesion and inclusion. Our approach includes the community feeling (Adler, 1964) as a useful component of the recommender algorithm that considers not only the individual preferences but also the individuals' awareness of being part of a certain community and how this feeling affects individuals' preferences when dealing with a set of communities in the social world. Community feeling is beneficial both for the individual and for society. Our approach also includes use of techniques of Citizen Curation (Ellwood et al., 2018; O'Neill, 2017; Robinson & Carletti, 2019). In the SPICE project we define Citizen Curation (Bruni et al., 2020) as citizens applying curatorial methods to archival materials available in heritage and memory institutions as well as to items depicted in exhibitions in order to develop their own interpretations, share their own perspective and

appreciate the perspectives of others. While our approach will clearly be to the benefit of society, we believe that this also reflects the values of the individual user who wishes to better understand their context and environment. Our goal here is that each member of society feels that he or she has a part of the society's cultural heritage in some manner. To clarify, this does not mean that each individual must come to a common understanding or interpretation, but rather that each individual will understand and perhaps even empathize with other members of the society's divergent views. Hopefully by citizen curation, i.e., by allowing people to give their own interpretations, we can increase inclusion; and by showing divergent views in an empathetic manner, we can increase social cohesion. To illustrate our ultimate goal, we describe the following scenario:

Lara decides to attend a Citizen Curation activity at a museum she is visiting. The activity involves selecting an artwork from the museum's collection and providing her own interpretation. Afterwards, after the system considers her interpretation, Lara is notified of an interpretation of the artwork contributed by someone from a different social group (this is accomplished via our social recommender). The interpretation is a personal story prompted by the artwork recorded as audio. The story is accompanied by comments responding positively to the story contributed by people in the first social group. Lara decides to listen to it. Before the audio recording starts, Lara is encouraged to imagine how the storyteller feels about what happened. The story is very different from her interpretation of the artwork. She adds her own comment after listening.

In the SPICE project, user models represent the individuals that are interacting with the system. Community models represent users' community, whether explicit or implicit (explicit – explicitly reported by the user, implicit – created automatically by the community modeler according to the users' generated content). These models are key elements (together with the curator's guidelines/scripts) used to guide the process of content recommendations to individuals, taking into consideration individual and community interests, as well as script guidelines (developed by WP6), to search and identify relevant users' contributions, to provide alternative interpretations of objects, and, as described above, to promote the social contagion among users and to emphasize the similarities and differences within and across communities.

In this document we review the studies carried out to identify how a social recommender may be used by the different case studies. The information was gathered through a series of project meetings and guided the development of the community model and a communication protocol to activate its services.

Description

The purpose of the Social recommender (RS) component is to provide recommendations of user generated content based on communities and experiential criteria (emotions, sentiments, values) to aid in the implementation of the interpretation-reflection loop of WP2; primarily reflection (Deliverable D2.4). One can choose similar viewpoints by members of a differing community to engender inclusion and use different viewpoints by members of similar communities to try and engender cohesion. Thus, the recommendations are based on similar and dissimilar views of topics and artworks and material from both similar and dissimilar

communities. Views of the subject/artworks are determined by the Semantic Analyser. (D3.2) The views can be based on the following criteria: emotions, sentiments (Additionally, work was done in the project to also allow values as a criteria) This is stored in the UM (user Model) for use by the CM (Community Model) who generates similar and dissimilar communities which is then used by the social recommender to provide recommendations.

The API consists of a single call which attempts to do as much as possible for the developer in providing recommendations of user generated content.

The purpose is to give the script designer the possibility to find people who have common background like me (same explicit community) but have a different/same opinion on the subject (as provided by Semantic Analyser) or people who think like me (same implicit community) but have a different/same opinion (as provided by Semantic Analyser). To this end a number of configuration options are provided:

1. Similar criterion similar community
2. Dissimilar criterion similar community
3. Similar criterion dissimilar community
4. Dissimilar criterion dissimilar community

The RS play with k (the number of) of similar communities and closeness of similarity of views to get a reasonable number of suggestions. In addition, The RS provides an explanation of the recommendation (based on whether this was similar or dissimilar views/communities). The RS also provides an entrancement, which is a suggestion/persuasive comment why they should view the recommendations (based on the goals of the recommendation, e.g., see other people's views …)
A typical scenario is that a recommendation of user generated content (opinion, curation and so on) is requested. User generated content is chosen based on the analysis of the Semantic Analyser (similar or dissimilar) it is then filtered by content belonging to users of certain communities.

To sum up the Figure 1. shows what are the inputs, outputs and data used by the Social Recommender

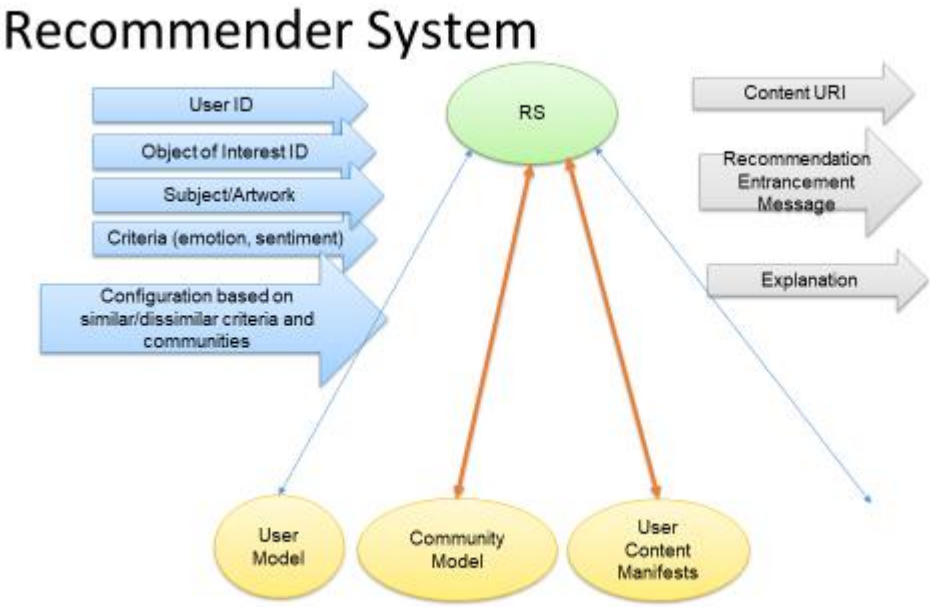


Figure 1: The inputs and interaction of the social recommender.

Process

In order to provide the recommendations, we use many parts of WP3: data is gathered first by the UM (D3.3), then the Semantic Analyser (D3.4), then then the Community Model (D3.6), these are then used by the Social Recommender to provide recommendations. In addition, the User Interface (WP5) is used to obtain the User Generated Content. LDH (WP4- D4.7) is used to store the data/models and Domain ontologies and reasonners (WP6) are used to enhance the models or enable reasoning about the data. These recommendations are used in SPICE according to the Interpretation-Reflection Loop (WP2) guidelines.

This process consists of two parts the first is a pipeline building up the User and Community Models, and the User Generated Content. The second is using those components to provide recommendations.

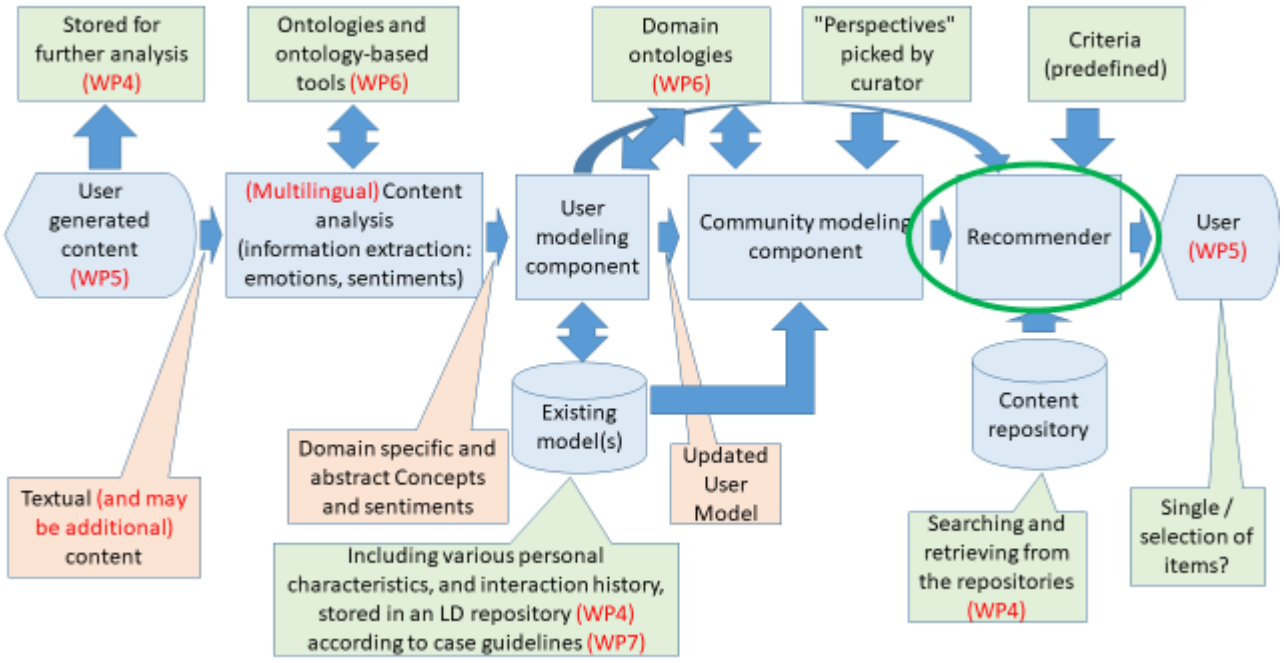


Figure 2: The social recommender pipeline illustration: user and community information is used for searching and delivering content to the user, plus roles of other work packages

Integration with Case Studies

With respect to the needs of the individual case studies (WP7), meetings were held with each of the case studies (IMMA, GAM, Madrid, Hecht, DMH) to understand their needs and use of the user and community models and implications for the recommender. This is summarized in table 1. Due to time and resource constraints, and especially given the parallel process of development of the case studies and the social recommender during the 2nd and 3rd years, different levels of implementation, integration were achieved

Table 1: SPICE case studies their community and recommendation subjects

Case Study	Explicit Community Characteristics	Implicit Community Characteristics	Subjects for recommendation	Level of Integration
IMMA	Specific invited Communities (LGBT+, Blacks, etc...	Based on Artwork Interpretation	Artworks	Spec
GAM	Schools, Deaf Teenagers	Level of Physical Challenges, similar responses	Artworks	Demo
Madrid	Schools	Attitudes toward climate change, Age, Rural vs Urban	Climate Change, Bio-Diversity, Sustainability	Spec
DMH	Age, Address	City vs Non City Dwellers (Need to see scenario of asylum seekers)	Artefacts	Demo

Hecht	Schools	Religion, Nationality, Religiosity, Values	Galilee Campaign, Josephus, Museum Curation	Integrated into app

3. Implementation Details

Part 1: Building up the necessary information

This has been described in other Deliverables such as the User Model(UM), Community Model (CM) and Semantic Analyser (SA). To recap:

1. UI provides User Generated Content (UGC)
2. SA to analyse UGC and tags metainfo (sentiment, emotion, *value*) to UGC
3. UM uses user info to construct properties
4. UM analyses all UGC to construct a user property
5. UM sends CM all the user's properties
6. UI sets CM perspective using CM VISIR (see deliverable D3.6 for more details)
7. CM builds communities

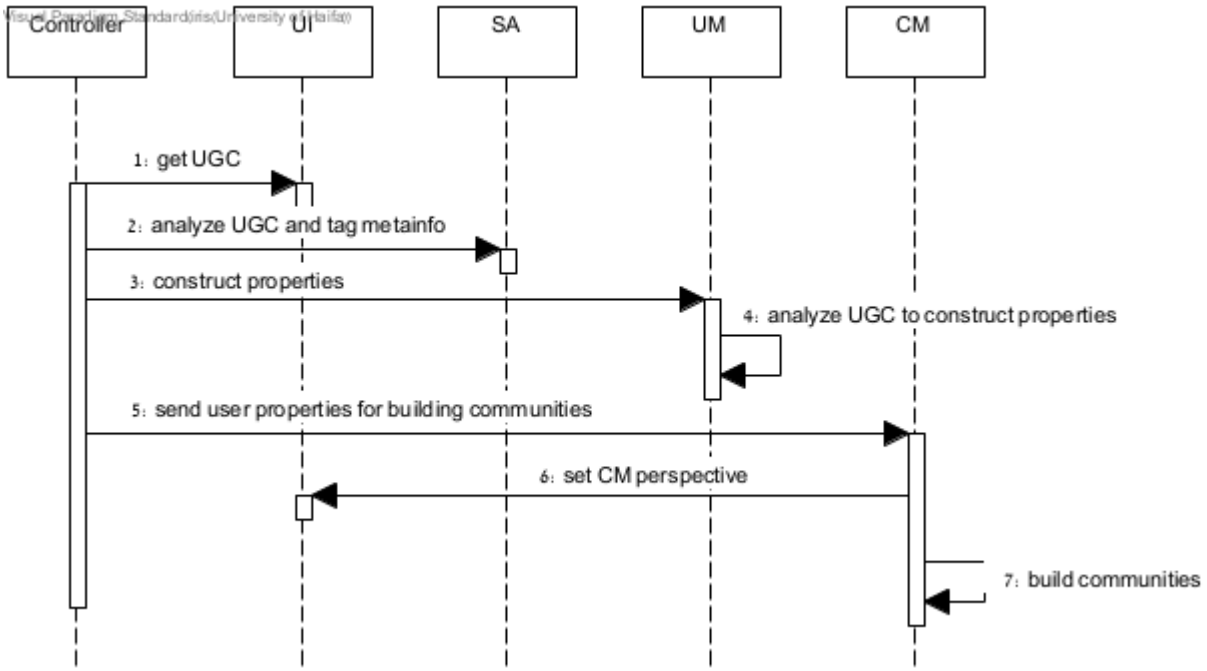


Figure 4: Data pipeline

A par that have been updated is the details of the CM call that updates the community model. In the call pname refers to the criterion, and origin is the artwork id. Also the use of perspectives.

[redacted] Part 2: Generating a recommendation

Here are the implementation steps :

1. Get the user's community from CM `get/{userid}/community`
2. Get the user's view (emotion, sentiment) on subject/artwork from UM `get/property/{userid}/{propertyname}`
3. Get user generated comments (ranked) which has similar or dissimilar view value (depending on configuration) from LDH `get/browse?query={query}`. Determine simililar/dissimilar through ontology or hardcoded.
4. Get communities similar/dissimilar to the user's community and their members from CM `get/communities/{communityid}/dis|simiilararity/k`
5. Filter out the user generated content to include only UGC by members in desired communities, if this doesn't produce enough recommendation increase k in step 4.
6. Build explanation and entrancement based on configuration

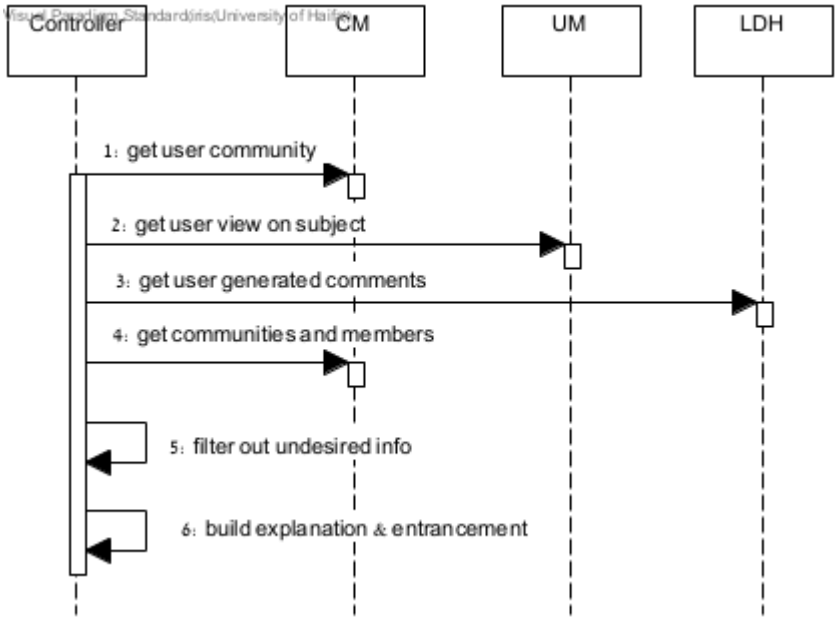


Figure 5: Generating recommendation

[redacted] Accessing the Social Recommender (API)

The following is the REST API: (Also described in Deliverable D6.8)

The recommendation controller is used to request appropriate user generated content

recommendation-controller

GET /api/v2/srec/{userid}/{subject}/{configNum}/{criterionInput} Get recommendation for user

Recommends on the basis of the userid, subject, configuration a ranked list of User Generated Content

Parameters

Name	Description
userid * **string** *(path)*	Anonymous id
subject * **string** *(path)*	Topic of interest or artwork
configNum * **string** *(path)*	1 – similar criterion similar community 2 – dissimilar criterion similar community 3 – similar criterion dissimilar community 4 – dissimilar criterion dissimilar community
criterionInput * **string** *(path)*	sentiment or emotion

Responses

Code	Description	Links
200	OK Media type */* Controls `Accept` header.	

	• **Example Value** • Schema "entrancement": "string", "explanation": "string", ugcs": [{ "source": "string", "context": "string", "createdAt": "string", "updatedAt": "string", "get_id": "string", "get_docType": "string", "id": 0, "userid": "string", "parentname": "string", "parenttype": "string", "contentType": "string", "ugcname": "string", "ugcimage": "string", "ugctags": "string", "ugcdesc": "string", "ugcmeta": [{}], emotions": {}, "sentiments": {}, "entities": {}, "ugcmeta2": "string", "topic": "string", "ugctext": "string	

4. Example of Use

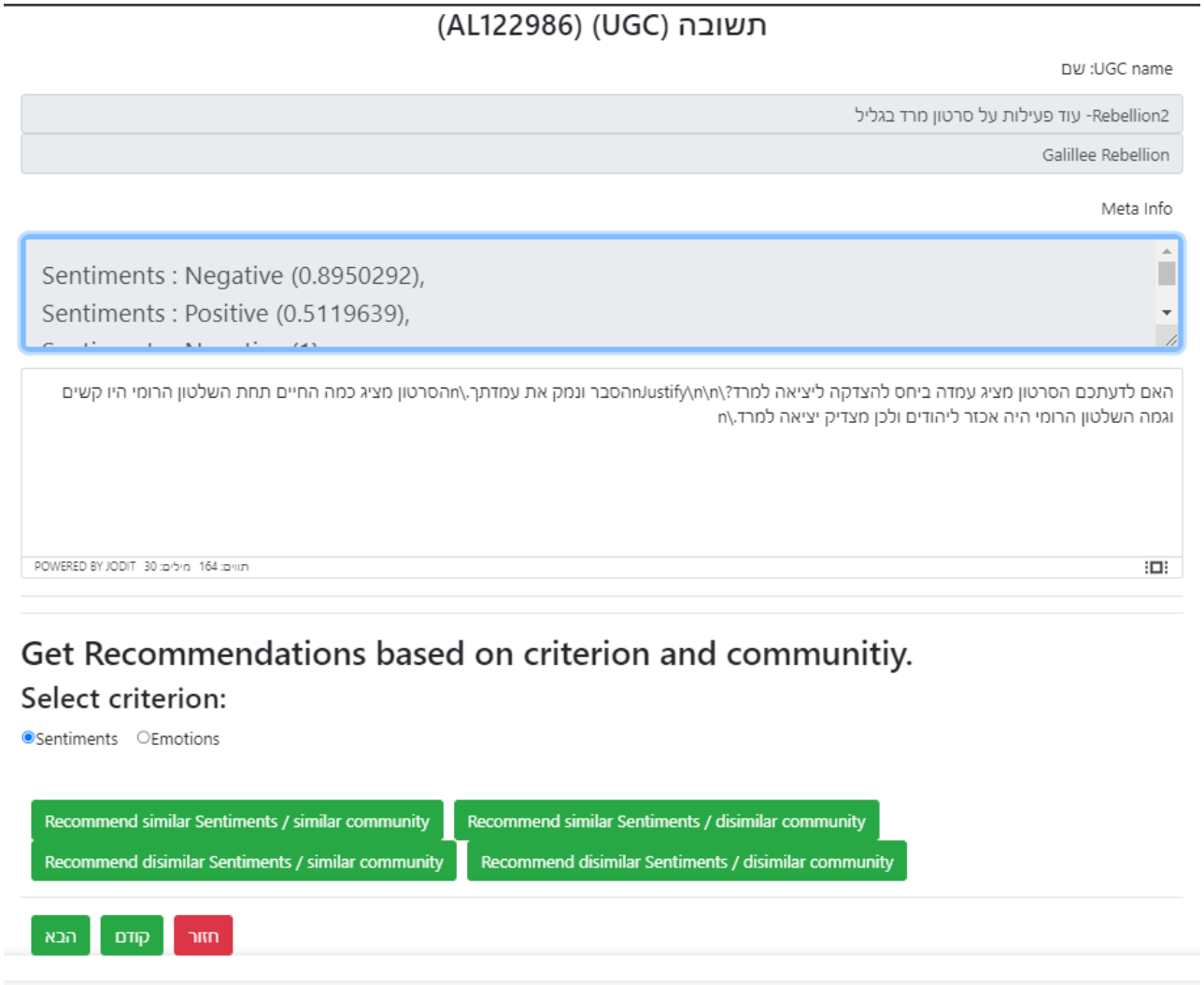
The first demo is a modified verson of the *studentmgr* app from the Hecht case study (https://hspice.haifa.ac.il/studentmgr2). In the app we allow the teacher to find material that is similar/dissimilar to those of a particular student's viewpoint.

The demo is built in React. Since React doesn't make REST calls directly (to the RS) we use the axios[1] library to wrap the REST API calls. In Appendix 8.3 we show the wrapping of the REST call for the Social Recommender.

[1] https://github.com/axios/axios

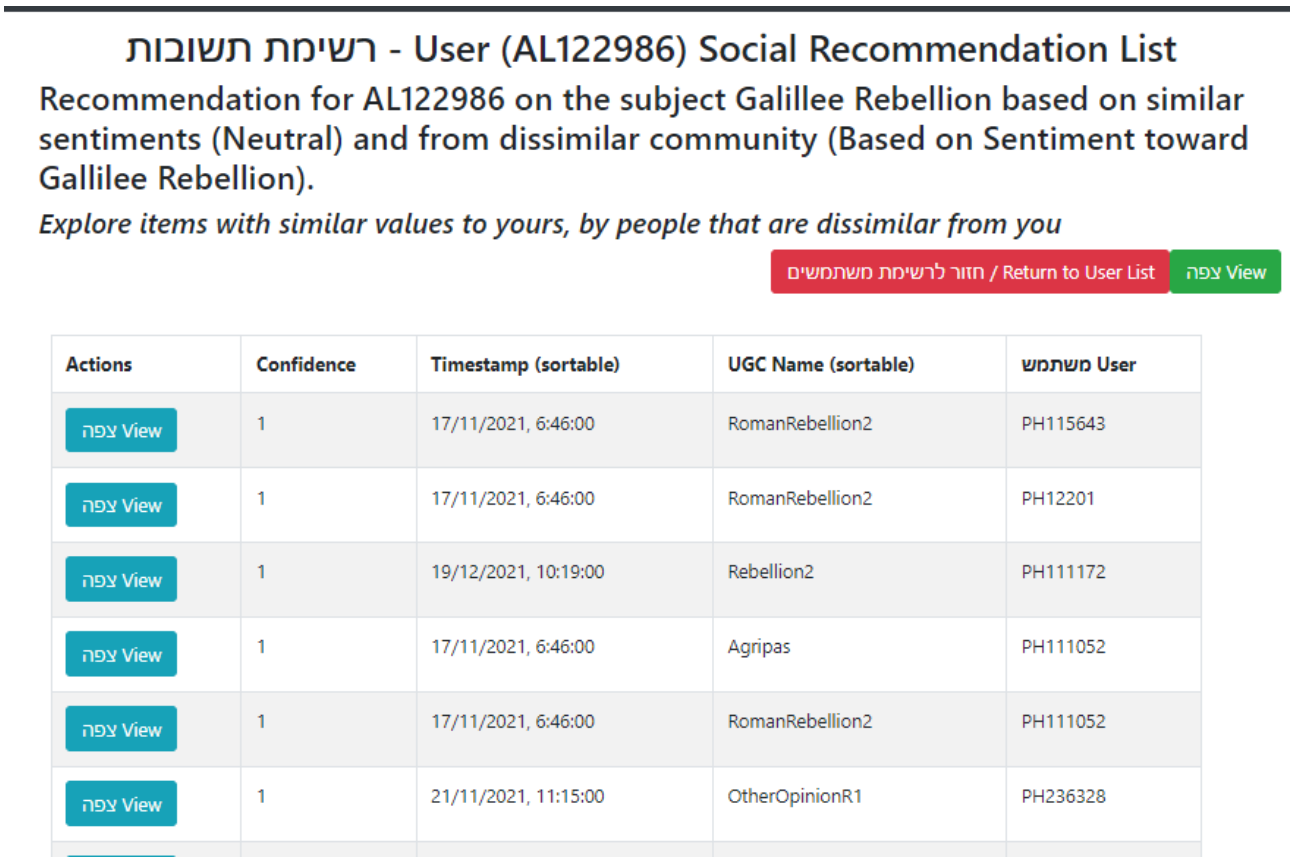
[redacted] Hecht Demo Query Interface

The following shows an example of User generated content with labels from the semantic analyser. At the bottom third of the screen, we see an interface to request a recommendation based on the author of the content, the author's communities, and whether to base this on emotions or sentiments.



[redacted] Hecht Demo Result Interface

The following shows the result of the previous query. It gives an explanation of what is in the list based on the user, the topic, the criteria (similar/dissimilar), the user's communities (similar/dissimilar) and what the communities were based on. The next sentence in italics is an entrancement to encourage the user to explore the list. This is followed by a ranked list of items.



רשימת תשובות - User (AL122986) Social Recommendation List

Recommendation for AL122986 on the subject Galillee Rebellion based on similar sentiments (Neutral) and from dissimilar community (Based on Sentiment toward Gallilee Rebellion).

Explore items with similar values to yours, by people that are dissimilar from you

חזור לרשימת משתמשים / Return to User List | צפה View

Actions	Confidence	Timestamp (sortable)	UGC Name (sortable)	User משתמש
צפה View	1	17/11/2021, 6:46:00	RomanRebellion2	PH115643
צפה View	1	17/11/2021, 6:46:00	RomanRebellion2	PH12201
צפה View	1	19/12/2021, 10:19:00	Rebellion2	PH111172
צפה View	1	17/11/2021, 6:46:00	Agripas	PH111052
צפה View	1	17/11/2021, 6:46:00	RomanRebellion2	PH111052
צפה View	1	21/11/2021, 11:15:00	OtherOpinionR1	PH236328

The second demo, allows the user to explore recommendations for users of the GAM, and DMH case studies.

5. Conclusions and future work

In general, for task of the social recommender the goals set were achieved. The heterogeneity of the case studies as well as their evolution during the 2nd and 3rd years, in parallel with the development of the social recommender, posed a challenge on the development of a generic social recommender. These constraints required us to suggest creative solutions to the uncertainty and lack of information about the intended use of the models in the case studies, which were useful in ensuring that the models are flexible and applicable to a wide range of scenarios. Continuous interaction with the case studies, flexible solutions to accommodate for changing requirements and simulations were adopted in order to allow us to achieve the goals. The third

year allowed us exploration of how a social recommender could be integrated in the various case studies. The integration and demo raised interesting questions about the effect of the social recommender which needs to be explored, to fully determine how best to use it. That is when does one use similar items to encourage inclusion and when do use different item to foster cohesion. Similarly, the question of what to foster first inclusion or cohesion needs to be further explored.

Other possible improvement would be for the RS to call CM for a further explanation about the community and allow the user to modify their community, recommending artwork/topics based on social criteria (as opposed to just user generated content).

6. Supplementary material

This document can be found at ZENODO (DOI according to version) 10.5281/zenodo.4708753

The source code for Version 2.0 for the Social Recommender can be found at 10.5281/zenodo.7870676

The deliverable consists of prototype code of REST APIs[2], built using the SPRING boot framework[3] and this document which describes the recommender and the role it plays in the overall project. In terms of deployment in the project, the intention is that each case study would instantiate its own version of the REST server. In addition, a REACT frontend[4] was developed which gives an example of how to use the REST services.

7. References

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[2] https://en.wikipedia.org/wiki/Representational_state_transfer
[3] https://spring.io/projects/spring-boot
[4] https://reactjs.org/

https://doi.org/10.1007/s00607-018-0687-5

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8. Appendix

Recommender File Structure

The structure of the file system is the same as usermodel D3.3 (with files in controller, model and repository directories) and uses a common codebase.

SPICE Social Recommender API REST

A more detailed description of the APIs can be seen in D6.8

React example of wrapped REST calls

8.3.1 Social Recommender Service

```
import axios from 'axios';
const USER_API_BASE_URL = "http://localhost:8080/api/v2/srec";
//
class RecommenderService {
    getConfigurations(user, subject, recConfig, criterion){
        return axios.get(USER_API_BASE_URL);
    }

}
export default new RecommenderService()
```