

Projecting Quality

Stephen Downes, H el ene Fournier, Chaouki Regoui

Presented at MADLaT, Winnipeg, May 7, 2004

Introduction

- Presentation of results from the *Sifter Organizer* project
- Collaboration with Mosaic Technologies, Inc.
- Selection of learning objects based on their metadata
- Filtering and sorting them according to their rated quality

Mosaic Technologies

- Created custom e-learning for corporate clients
- Employed instructional designers in production
- Required streamlined LO search and retrieval
- Ultimate objective: zero time of development

Our Proposal

- Describe learning resources using metadata
- Harvest metadata from various repositories
- Develop LO evaluation metadata format
- Employ evaluation results in search process

Previous Work

- Multimedia Educational Resource for Learning and Online Teaching (MERLOT) <http://www.merlot.org>
- Learning Object Review Instrument (LORI)
<http://www.elera.net/eLera/Home/About%20%20LORI/>
- Various definitions of evaluation criteria
 - eg. DESIRE <http://www.desire.org/handbook/2-1.html>
 - Nesbit, et.al. http://www.cjlt.ca/content/vol28.3/nesbit_etal.html

MERLOT

- Peer review process
- Materials 'triaged' to presort for quality
- 14 editorial boards post reviews publicly
- Criteria (five star system):
 - Quality of Content
 - Potential Effectiveness as a Teaching-Learning Tool
 - Ease of Use

LORI

- Members browse collection of learning objects
- Review form presented, five star system, 9 criteria
- Object review is an aggregate of member reviews

The Human digestive system

Learning Object Review Instrument	Low	1	2	3	4	5	High	N/A	Comments:
1. Content Quality				★	★	★	★		
Veracity, accuracy, balanced presentation of ideas, and appropriate level of detail >> more >>									
2. Learning Goal Alignment				★	★	★	★		
Alignment among learning goals, activities, assessments, and learner characteristics >> more >>									
3. Feedback and Adaption				★	★	★	★		
Adaptive content or feedback driven by differential learner input or learner modeling >> more >>									

Issues (1)

- The peer review process in MERLOT is too slow, creating a bottleneck
- Both MERLOT and LORI are centralized, so review information is not widely available
- Both MERLOT and LORI employ a single set of criteria – but different media require different criteria

Issues (2)

- Results are a single aggregation, but different types of user have different criteria
- In order to use the system for content retrieval, the object must be evaluated

What we wanted...

- a method for determining how a learning resource will be appropriate for a certain use when it has never been seen or reviewed
- a system that collects and distributes learning resource evaluation metadata that associates quality with known properties of the resource (e.g., author, publisher, format, educational level)

Recommender Systems

- “*Collaborative filtering or recommender systems use a database about user preferences to predict additional topics or products a new user might like.*” (Breese, et.al., <http://www.research.microsoft.com/users/breese/cfalgs.html>)

- The idea is that associations are mapped between:

- User profile – properties of given users
- Resource profile – properties of the resource
- Previous evaluations of other resources

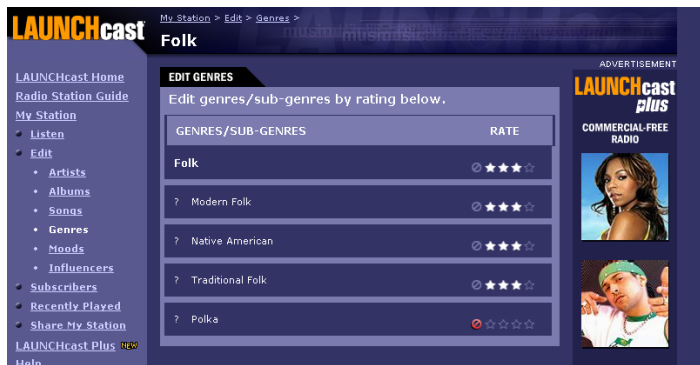
(See also <http://www.cs.umbc.edu/~ian/sigir99-rec/> and <http://www.iota.org/Winter99/recommend.html>)

Firefly

- One of the earliest recommender systems on the web
- Allowed users to create a personal profile
- In addition to community features (discuss, chat) it allowed users to evaluate music
- User profile was stored in a 'Passport'
- Bought by Microsoft, which kept 'Passport' and shut down Firefly (see <http://www.nytimes.com/library/cyber/week/062997firefly-side.html> and <http://www.nytimes.com/library/cyber/week/062997firefly.html>)

Launch.Com

- Launched by Yahoo!, allows users to listen to music and then rate selections
- Detailed personal profiling available
- Commercials make service unusable, significant product placement taints selections <http://www.launch.com>



Match.com

- Dating site
- User creates personal profile, selection criteria
- Adds 'personality tests' to profile

The Match.com Profile

Basics Photos Personality Physical

Next Step →

How creative are you? Are you shy or outgoing, whimsical or pragmatic? find out in **only 5 minutes!**

Explore your personality traits and quirks and find out what type of personality is right for you using Match.com's Ph.D.-designed Personality Test.

When you're finished, we'll send your FREE Personality Report and allow you to include highlights from it in your

Your Match.com Profile

✓ Basics	
Photos	
Personality	25% completed
Physical	

How social is she?

mostly shy & introverted your ideal mostly outgoing

Our Methodology

- Perform a multidimensional quality evaluation of LOs (multi criteria rating)
- Build a quality evaluation model for LOs based on their metadata or ratings
- Use model to assign a quality value to unrated LOs
- Update object's profile according to its history of use
- Identify most salient user profile parameters

Rethinking Learning Object Metadata

- Existing conceptions of metadata inadequate for our needs
 - Getting the description right
 - The problem of trust
 - Multiple descriptions
 - New types of metadata
- The concept of *resource profiles* developed to allow the use of evaluation metadata

Resource Profiles

- Multiple vocabularies (eg., for different types of object)
- Multiple authors (eg., content author, publisher, classifier, evaluator)
- Distributed metadata (i.e., files describing the same resource may be located in numerous repositories)
- Metadata models
- Analogy: personal profile

See http://www.downes.ca/files/resource_profiles.htm

Types of Metadata

First Person	Second Person	Third Person
<ul style="list-style-type: none">- Bibliographic- Technical- Rights	<ul style="list-style-type: none">- Educational- Sequence and Relational- Interaction	<ul style="list-style-type: none">- Evaluation- Classification
<i>Created by the content author or publisher</i>	<i>Created by the content user (in the process of use)</i>	<i>Created by disinterested third parties</i>

Evaluation Approach...

- Development and definition of evaluative metadata
- Expanding evaluation schema to include user types with a set of relevant ratings at different levels of detail
- Quality evaluator for the assessment of perceived subjective quality of a learning object based on criteria specific to each type of object

Our Approach

- Quality evaluator using LO type-specific evaluation criteria with rating summary or 'report card'
 - information according to eight groups of LO users
 - weighted global rating
 - user-tailored weighting; user preferences of the evaluation quality criteria
- Combination of subjective quality values that are purposefully fuzzy

Sample Schema

Example Learner1EVALSCHEMA

User type = Learner

⊕ Set of relevant ratings = level 1

<u>Cat_Ratings_Metadata</u> extension	Image	Audio	Video	Text
Level 1_Overall	minimum quality index: 0-10 scale, 0.5 increments	minimum quality index: 0-10 scale, 0.5 increments	minimum quality index: 0-10 scale, 0.5 increments	minimum quality index: 0-10 scale, 0.5 increments
Level 1.1_1Quality of experience	"	"	"	"
Level 1.2_ satisfaction	"	"	"	"
Level 1.3_interest	"	"	"	"

Sample Schema (2)

Example Instructor2EVALSCHEMA

User type = Instructor
Set of relevant ratings = level 2

<u>Cat_Ratings_Metadata</u> extension	Image	Audio	Video	Text
Level 2.1_ Quality of content	minimum quality index: 0-10 scale, 0.5 increments	minimum quality index: 0-10 scale, 0.5 increments	minimum quality index: 0-10 scale, 0.5 increments	minimum quality index: 0-10 scale, 0.5 increments
Level 2.1.1_accuracy	"	"	"	"
Level 2.1.2_aesthetic appeal	"	"	"	"
Level 2.1.3_consistency	"	"	"	"
Level 2.1.4_readability	"	"	"	"
Level 2.1.5_Appropriateness of representation	"	"	"	"
Level 2.2: Educational value	"	"	"	"
Level 2.2.1_clarity of				

Representing Evaluation Data

- Using the schemas defined, evaluation data is stored as XML files
- These XML files are aggregated alongside learning object metadata
- Evaluation data may then be aggregated or interpreted

The Sifter Harvester

SEARCH CRITERIA

Harvest From: LO Repository
 RSS-LOM

General
 Keywords:

Granularity of Learning Object:

Intended User:

Learning Resource Type:

Cost:

Copyright restriction:

Min Quality Index:

Harvest Results

Harvest Time: 0 seconds
 Items Found: 2

Pedagogic Type	Initial results	Adjusted results	Browse	Deploy
Program	0		<input type="checkbox"/>	<input type="checkbox"/>
Course	1		<input type="checkbox"/>	<input type="checkbox"/>
Unit	0		<input type="checkbox"/>	<input type="checkbox"/>
Lesson	0		<input type="checkbox"/>	<input type="checkbox"/>
Component				
Application	0		<input type="checkbox"/>	<input type="checkbox"/>
Audio	0		<input type="checkbox"/>	<input type="checkbox"/>
Image	0		<input type="checkbox"/>	<input type="checkbox"/>
Webpage	1		<input type="checkbox"/>	<input type="checkbox"/>
Text	0		<input type="checkbox"/>	<input type="checkbox"/>
Video	0		<input type="checkbox"/>	<input type="checkbox"/>
Others	0		<input type="checkbox"/>	<input type="checkbox"/>
All L.O.	2		<input type="checkbox"/>	<input type="checkbox"/>

<http://sifter.elg.ca> stephen monctonz

The Sifter Tagger

The screenshot shows the 'Sifter Metadata Tagger' application running in Microsoft Internet Explorer. The interface includes a menu bar (File, Edit, View, Search, Filter, Crawl, Config, Help) and a status bar (VERSION: .78). The main area displays the following information:

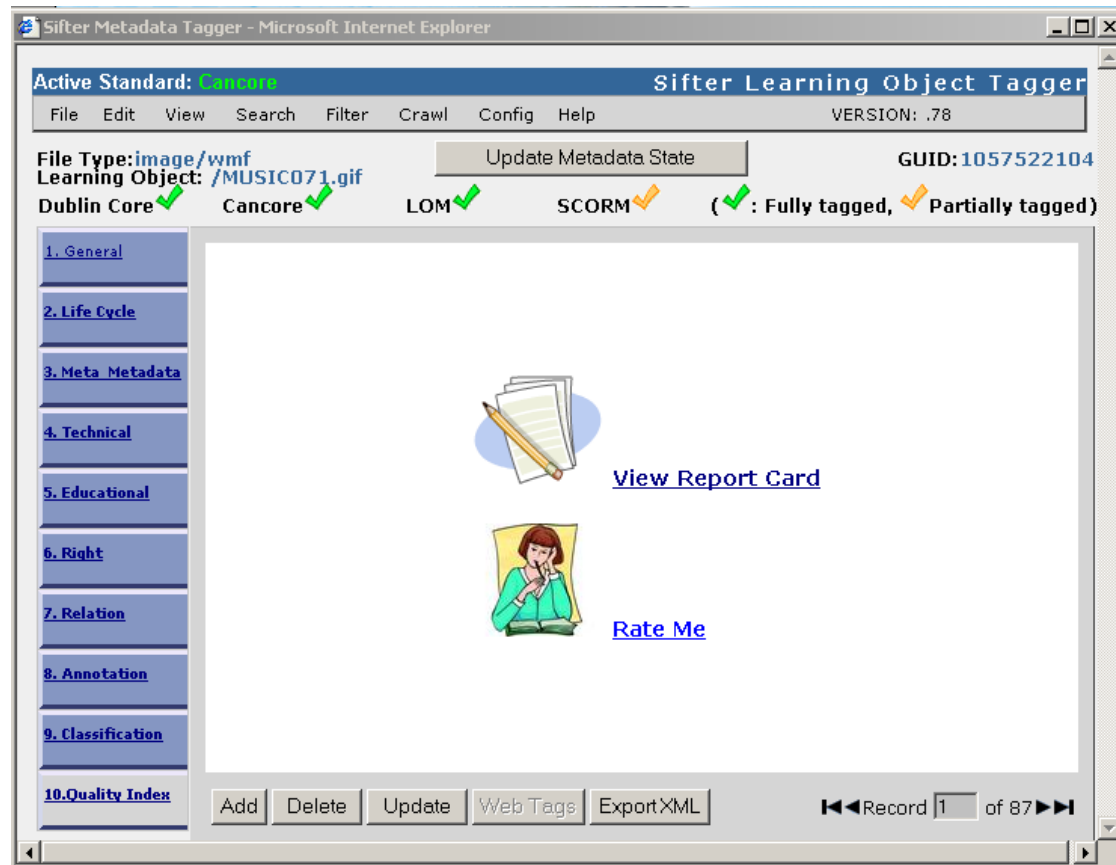
- Active Standard:** Cancore
- Sifter Learning Object Tagger**
- File Type:** image/wmf
- Learning Object:** /MUSIC071.gif
- Update Metadata State** button
- GUID:** 1057522104
- Dublin Core** ✓ **Cancore** ✓ **LOM** ✓ **SCORM** ✓ (✓: Fully tagged, ✓ Partially tagged)

The main configuration area is divided into sections on the left and a list of fields on the right:

Section	Field	Value
1. General	.1 Identifier	1057522104
	.1.1 Catalog	URI
3. Meta Metadata	.1.2 Entry	1057522104
	.2 Title	Speaker graphic
4. Technical	.3 Language	fr-CA
	.4 Description	graphic of an audio speaker
7. Relation	.5 Subject & Keyword	speaker, cartoon, graphic
	.6 Coverage	none
8. Annotation	.7 Structure	Linear
	.8 Aggregation level	1

At the bottom, there are buttons for 'Add', 'Delete', 'Update', 'Web Tags', and 'Export XML', along with a record indicator: 'Record 1 of 87'.

Sifter Tagger with Rater



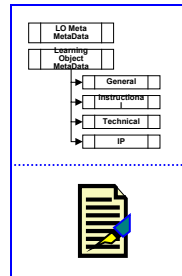
4 LO scenarios

- Content only

**- Content +
- Metadata**

**- Content +
- Evaluations**

**- Content +
- Metadata +
- Evaluations**



The User Profile

- user description data: required or available for the user to enter via sign-in forms for example:
 - user information: age, gender, occupation, education level...
 - user preferences: language, topics of interest, choice of media...
- automatically collected user data (user platform: OS, connection bandwidth ...)

LO Filtering

- Content filtering: based on content similarities (metadata-based) with other LOs (data scenario 2)
- Collaborative filtering: used when only ratings of LOs are available, no metadata (data scenario 3). It is carried out in two steps:
 - finding other users that exhibit similar rating patterns as the target user (called user neighborhood) by means of clustering algorithms
 - recommending LOs that have not been rated by target user according to their ratings by his neighborhood users

Sifter Harvester (2)

Tagged Learning Objects Browser							
Results 1 - 2 of 2						Page 1 of 1	
Download Free Tools to View LO						Results per page: 10 20 50 100	
No.	Description	Type/Format	Size	Year	Owner	View	Report
1	XML Tutorial. prev next XML Tutorial. In our XML tutorial you will learn what XML is and the differe	text/html	17k	2003	W3Schools		
2	The TopXML XSLT tutorial introduces you to the basics of XSLT concepts, syntax, and programming. ...	text/html	34k	0000	abc		

1

[Close Window](#)

Results screen

Sifter Harvester (3)

Report Card - Microsoft Internet Explorer

Learning Objects Report Card

Object ID: 1060204268 Others

(Rating: 1=Poor 10=Excellent)

Report Group	Reports	Avg. Rating	Detail
1 Learner	0	0	
2 Teacher	0	0	
3 Institution	0	0	
4 Company/Business	0	0	
5 Developer/Designer	0	0	
6 Tester	0	0	
7 QA Specialist	0	0	
8 Administrator	0	0	
Weighted Rating:	0	0	

Evaluation Report

Sifter Harvester (4)

Evaluator

TEACHER: LO Quality Rating - Microsoft Internet Explorer

Object ID: 1060204268 Others

Quality Rating	Poor 1										Excellent 10										NA
Overall Quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clarity of Learning Objective(s)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Level of Interaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Navigation Aids	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Content Quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Writing Style	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Help System	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graphics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Simulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exercises	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Questions/Problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pre/Post Test Questions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teaching Effectiveness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teacher/Tutor Quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to Motivate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

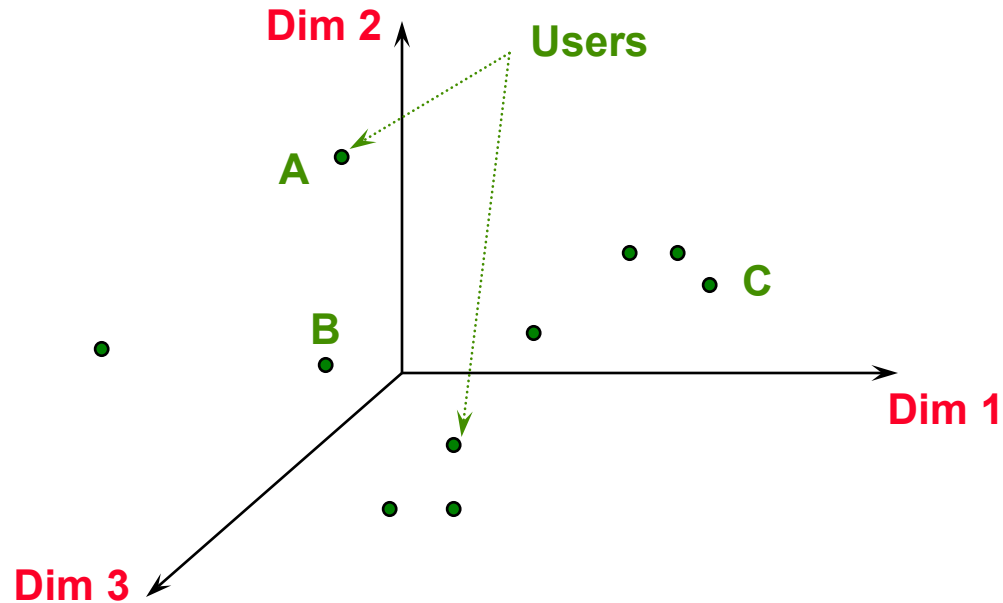
Select "NA" for items that do not apply to this Learning Object Submit Quality Rating

LO Quality Prediction

- Calculating object's similarity with other rated LOs based on their content metadata
- Calculating user similarity
 - clustering of the users based on their profiles (users with same preferences, competence and interests)
 - co-rated LOs (rating patterns)
- Predict quality value of the unrated LO by the target user using target user neighborhood rating of similar LOs

User similarity : User Space

User profiles Similarity

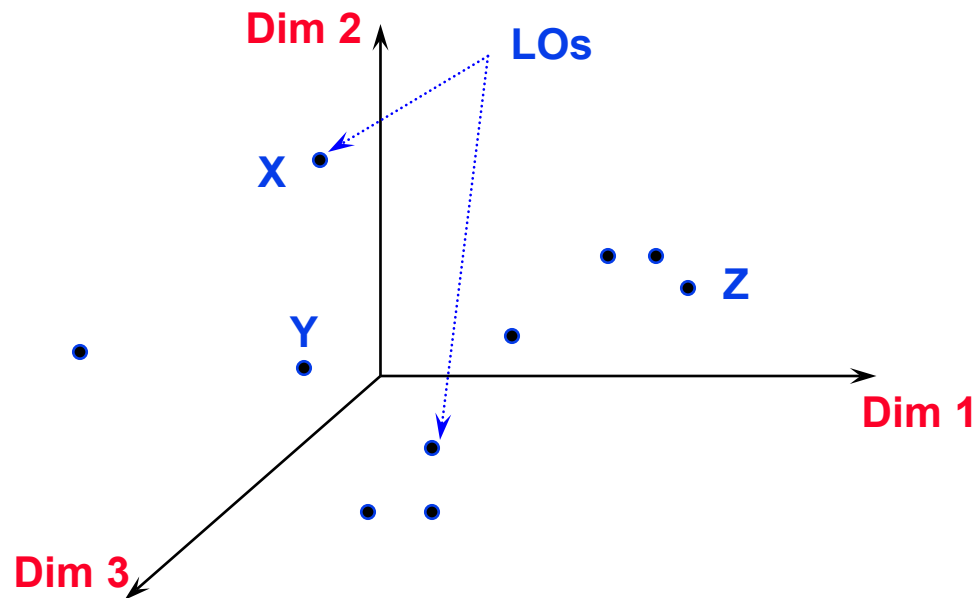


User space dimensions

User profile elements

LO similarity : LO Space

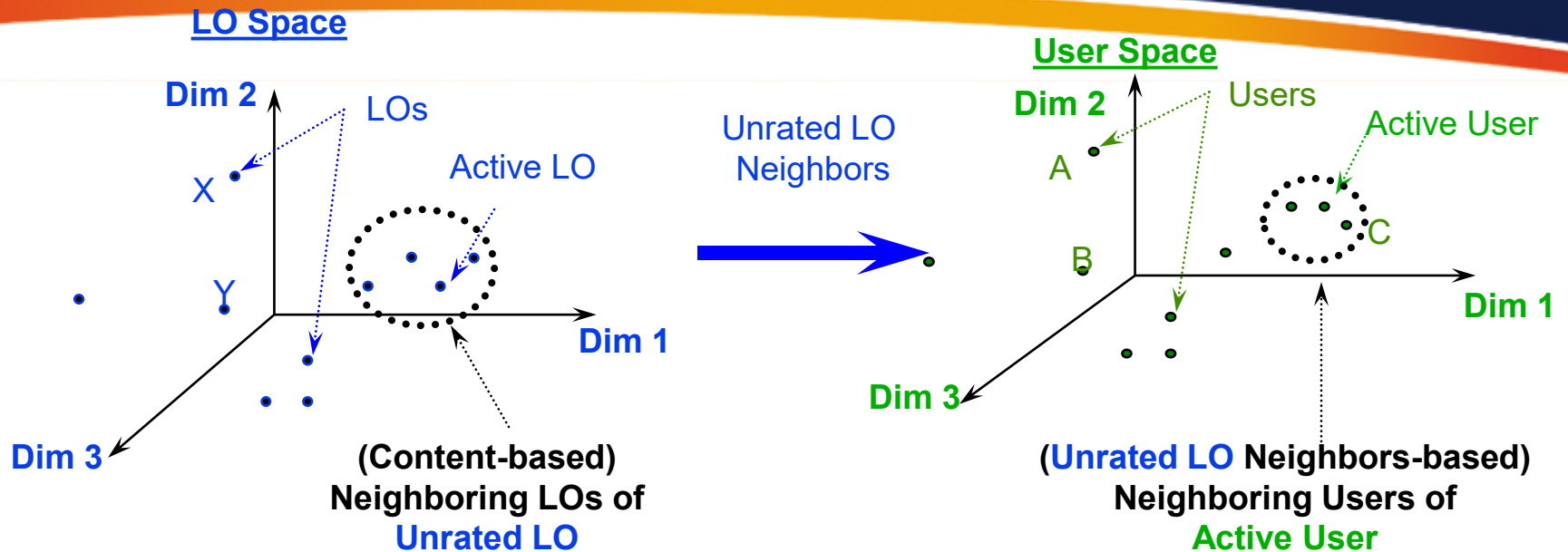
LO profiles Similarity



LO space dimensions

- Ratings (a dimension for each quality evaluation criterion),
- Some descriptive Metadata (Author, publisher, Last update ...)

LO quality prediction



1- Neighboring LOs of Unrated LO are computed based on content

2- Neighboring Users of Active User are computed for All users based on Unrated LO's neighboring LOs only (To ensure comparison of same category of LOs ratings)

Clustering (non-supervised classification) of LOs & Users