Profile Diversity for Query Processing using Users Recommendations

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Outline

1. Recommendation for Scientific Data
   – Use case: botanic data (Pl@ntnet)
2. Profile Diversity
3. Distributed and Diversified Recommendation
4. Demo
5. Conclusion

On-Line Communities: Citizen Sciences Context*

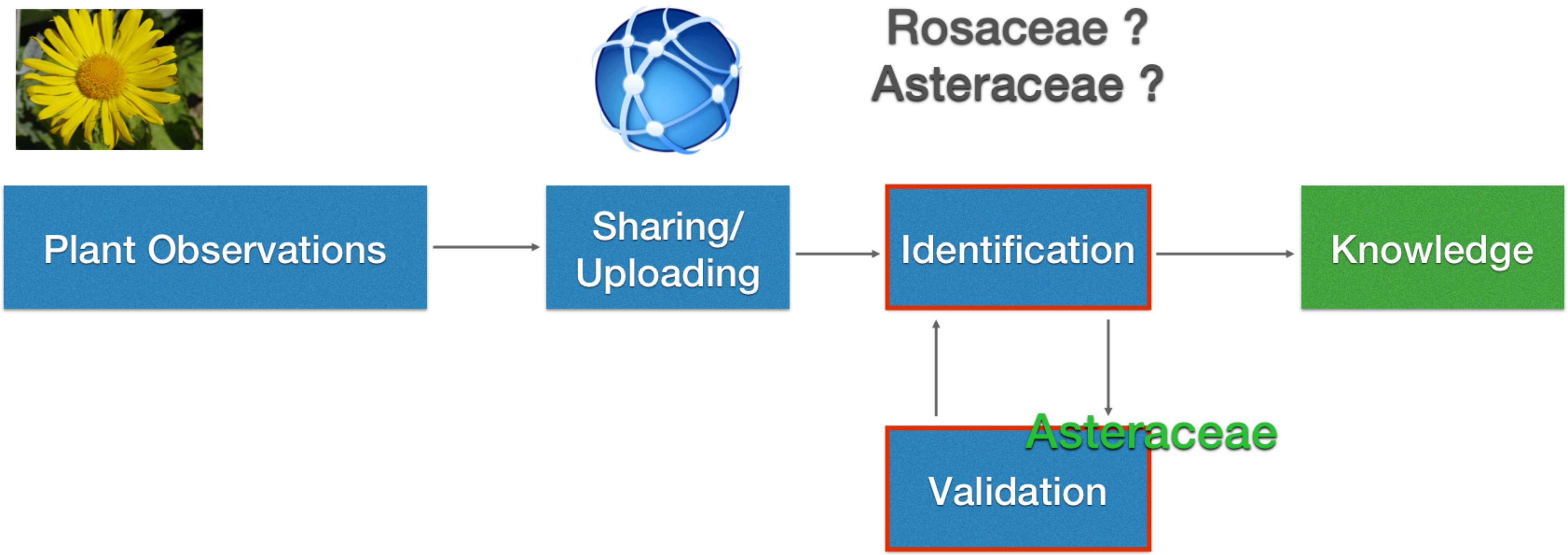
- Accurate knowledge of plant identities, in different geographic localities is essential for:
  - agricultural development
  - plant diversity preservation
- Pl@ntnet project*:
  - Interactive plant indentification and
  - Collaborative Information Systems
- Big Data production

*http://www.plantnet-project.org/page:projet?langue=en

Context

- Large scale of users with different goals, profiles and interests
- Quering such data requires careful method to be able to gain access to useful information.
- Ex: Grapevine plants identification and preservation, requires considerable knowledge of the potential of different grape varieties and their specific morphological characters

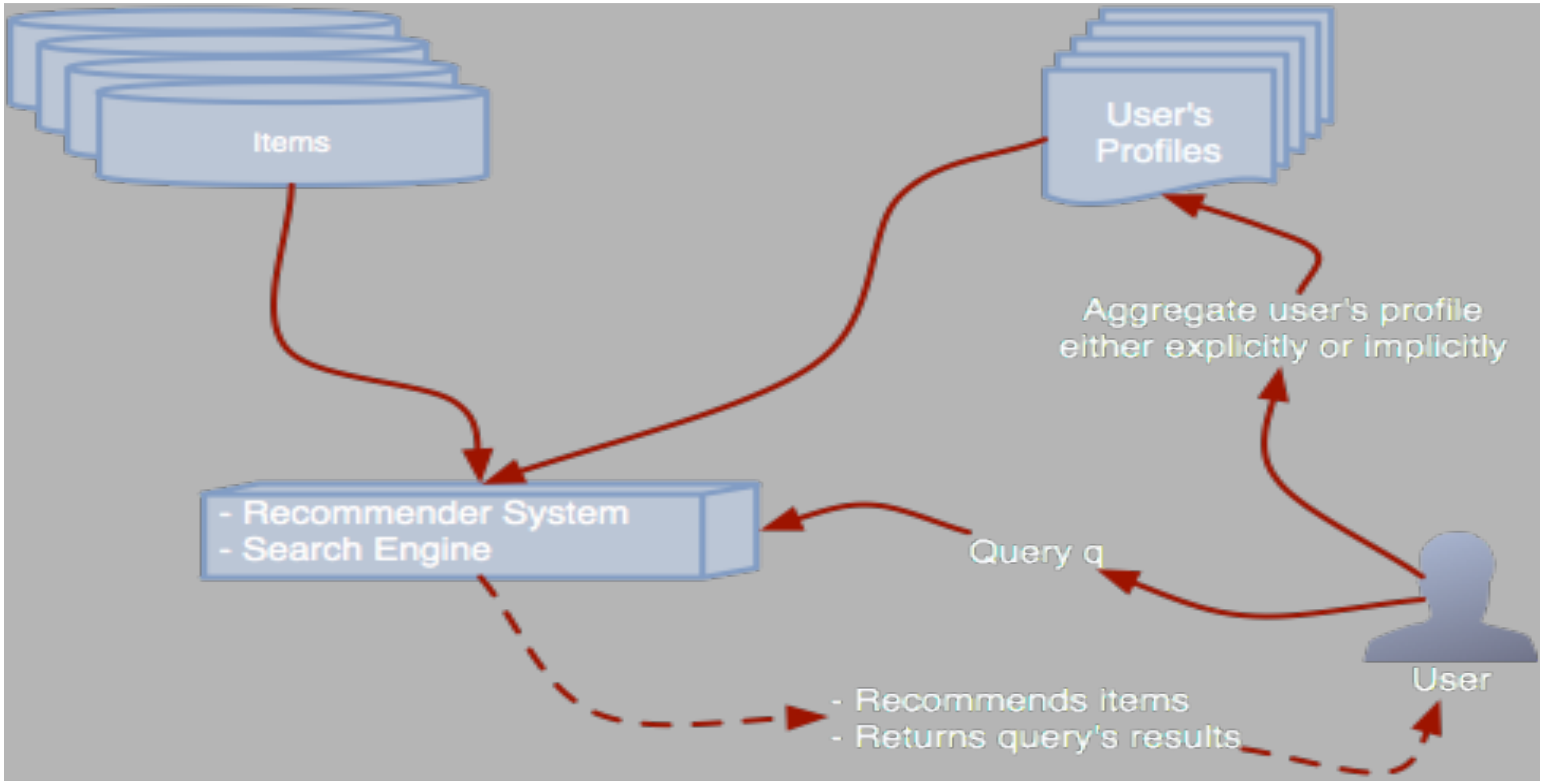
Plant Observation Process



General Problem:

Retrieve/recommend the k most diverse plant observations given a query (e.g grapewine) ?

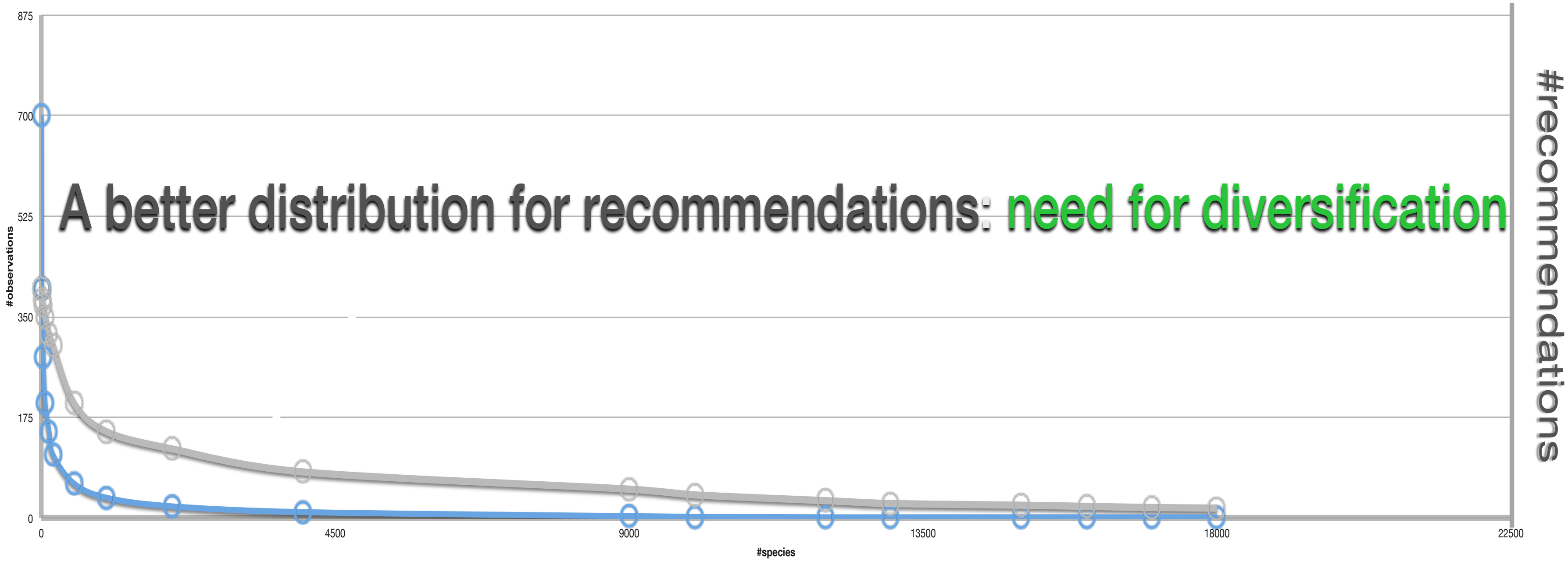
Search and Recommendation



Seek to recommend items given a query

However typically recommendation methods tend to propose redondant or too popular items, because normally the **relevance** of an item wrt to query is based on **similarity or popularity**.

Need for Diversification



A few plants represents the majority of the observations

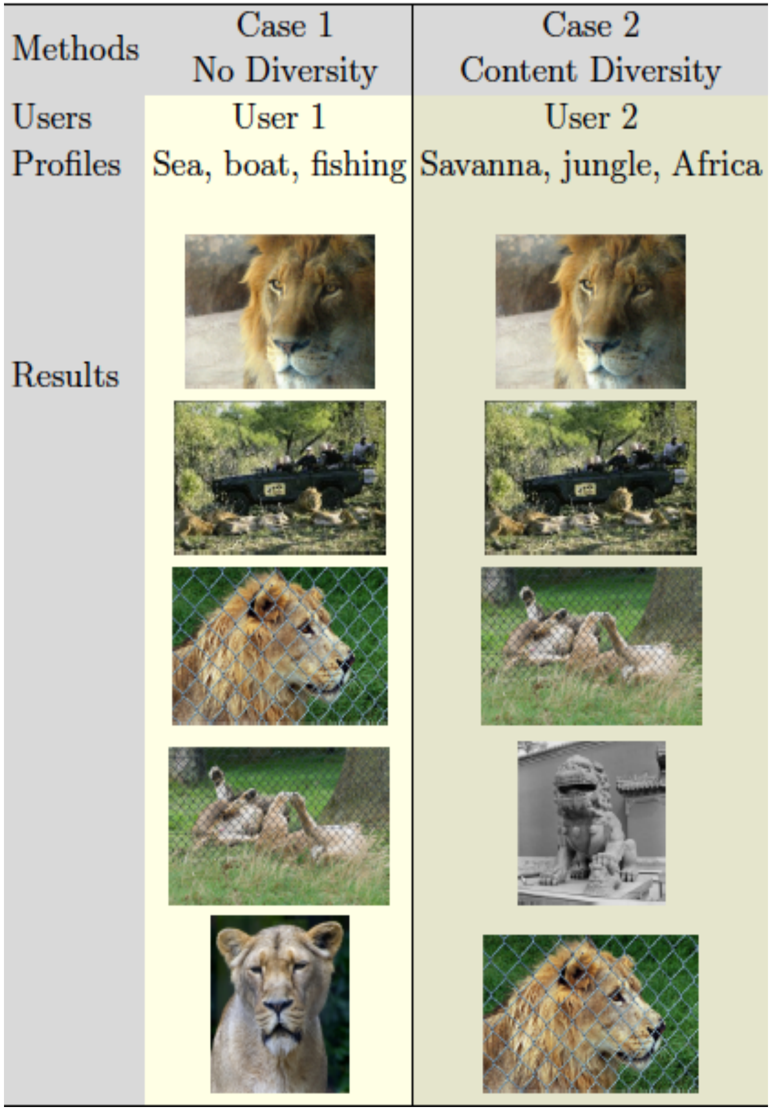
The majority of the plants are rarely observed

[1] JOLY, Alexis, GOËAU, Hervé, BONNET, Pierre, et al. Interactive plant identification based on social image data. Ecological Informatics, 2013.
[2] http://www.bugwood.org, 2014

Diversification in Search in Search an Recommendation

- *<u>Recall</u> in information retrieval is the fraction of the items that are relevant to the query that are successfully retrieved*.
- Given query *q* and the candidates items for *q*, the <u>diversity</u> is mesured by mesuring the distance of among selected *items* in the response.

Use Case with Delicious



Content Diversity [Angel, Sigmod 2011] has been used with promising results

However it presents low diversity gains due to:

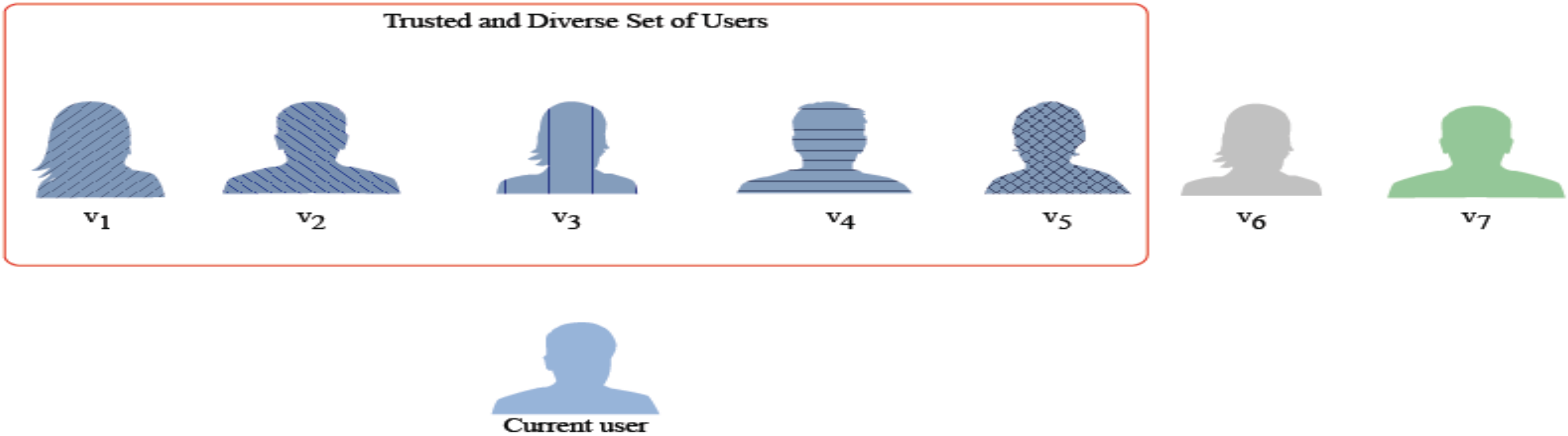
- -poor content description
- - semantic ambiguity

Ex: Java Language x Java Island

Profile Diversity*

- Users profiles are defined based on the items they share
- The relevancy takes into account similar and diversified users, wrt to the items they share.

*With **profile diversity***, the recommended items, in addition to be relevant to the query, and to the user profile, also take into account the diverse relevant users profiles and their items.*



Search and Recommendation

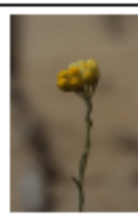
$q = asteraceae$		
Un-diversified	Profile Diversity	
Élodie Dujardin	Marie Dupont	Pierre Durand
		
		
		

Table I: Search and recommendation example with profile diversity.

ASTERACEAE, Leucanthemum adustum - Montpellier (34)

ASTERACEAE, Leucanthemum atratum - Montpellier (34)

ASTERACEAE, Cichorium intybus - Montpellier (34)

...

(a) Élodie's Profile

ASTERACEAE, Cirsium vulgare - Palavas (34)

ASTERACEAE, Cichorium intybus - Paris (75)

ASTERACEAE, Crepis vesicaria - Montpellier (34)

...

(b) Marie's profile.

RHAMNACEAE, Ramnus alaternus L. - Montpellier (34)

ASTERACEAE, Echinops ritro L. - Montpellier (34)

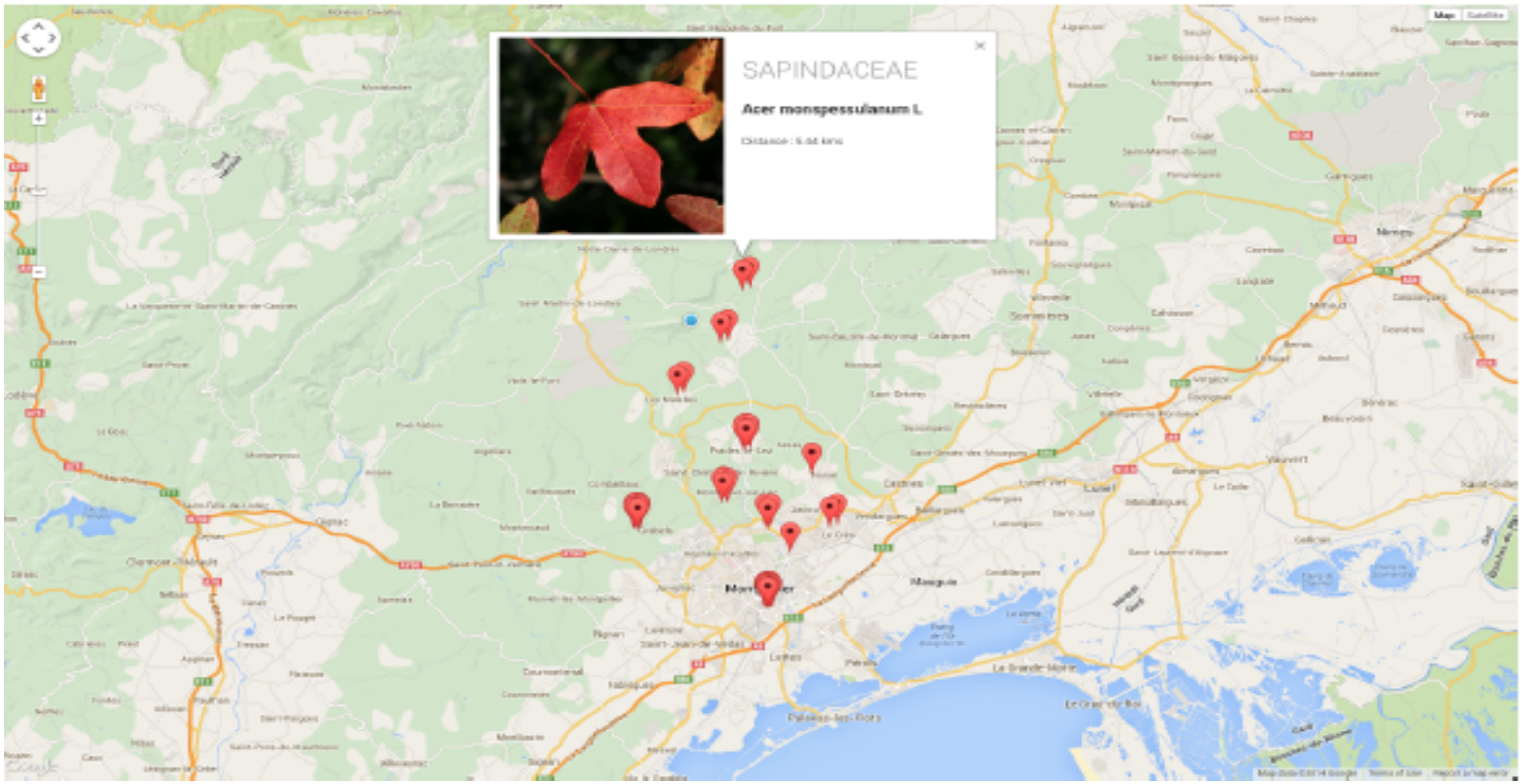
ASTERACEAE, Senecio doronicum - Montpellier (34)

...

(c) Pierre's profile.

Figure 2: User profiles.

Diversity of Plants in a Geographical Locality



Provide all plant diversity given a geographical area (bleu point)

Search and Recommendation Model

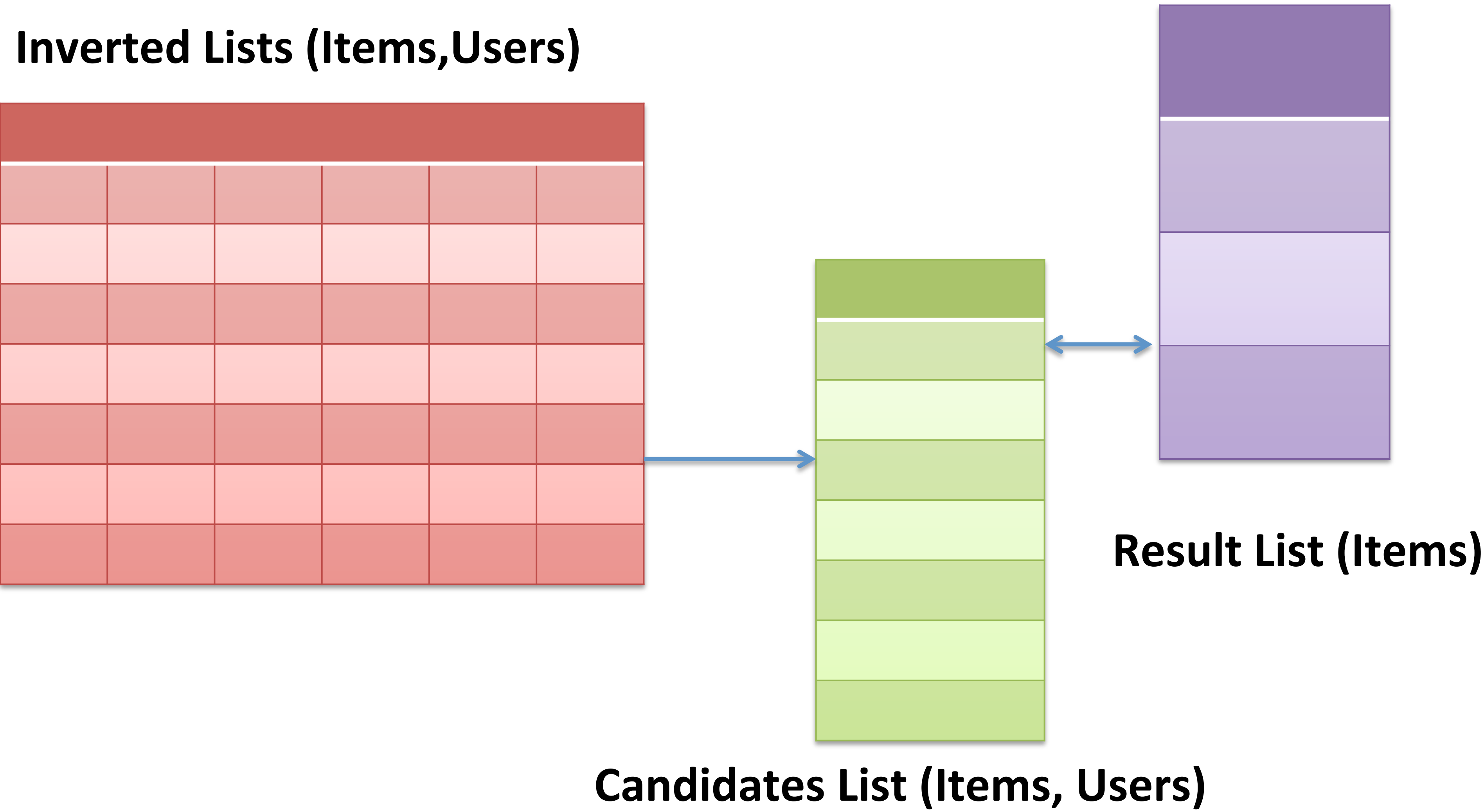
$$score(it_i, u, q) = \underbrace{rel(it, q)}_{\text{Relevance}} \times \underbrace{div_c(it_i | \{it_1, ..., it_{i-1}\})}_{\text{Content Diversity}} \times \underbrace{div_p(u_{it_i} | u_{\{it_1,...,it_{i-1}\}})}_{\text{Profile Diversity}}$$

$$\underbrace{div_p(u_{it_i} | u_{\{it_1,...,it_{i-1}\}})}_{\text{Profile Diversity}} = \frac{1}{N} \times \sum_{v_n \in u_{it_i}} \underbrace{rel(u, v_n, q)}_{\text{User Relevance}} \times \underbrace{\prod_{v_m \in u_{\{it_1,...,it_{i-1}\}}} 1 - red(v_n | v_m)}_{\text{User Diversity}}$$

Good Compromise between Relevancy and Diversity

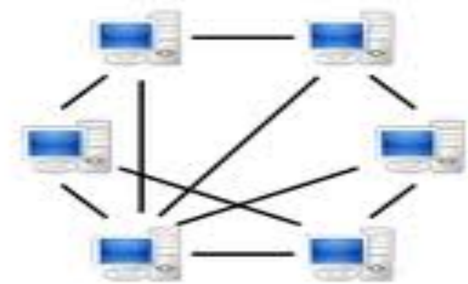
[Servajean et al. WWW 14]

Search and Diversified Recommendation



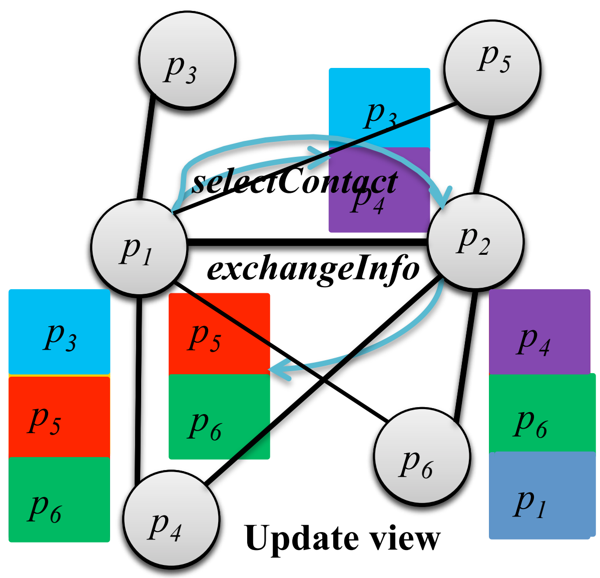
Distributed Recommendation for Citizen Sciences

- Single users
  - Users keeps observations in their own workspace
  - Scales-up (more network traffic)
  - Better for privacy
- Multi-Sites center (local clouds)
  - Users keeps observations in the local site server
- Hybrid



Distributed Search and Recommendation Model

- **Model:** G =(U,I,E), U = users nodes, I = items, E = edges among users
- **User profiles** are defined based on the items they share
- **User network (U-net):** refers to the cluster of relevant users profiles a users *u* is aware of through epidemic protocols.
- An edge exists between a *u* and *v*, if *v* is in *u*'s U-net.
- When a **keyword query** is submitted, it is recursively redirected to the **Top-n** similar users in the **U-net**, until TTL.
  - Each involved user computes recommend the most relevant items.



Diversity to increase Coverage

- Coverage
  - probability of finding relevant users to provide relevant items for a given query
  - depends on the clustering metric
- Clustering metric
  - similarity (e.g. cosinus, jaccard, etc).[Draidi 10, Xiao 2011, Isaila 12, Kermarrec 12]
  - at each exchange p_1 discovers new users and computes:

    similarity(profile(p_1), new profiles(p_i))

    p_1 keeps only the most similar users p_i in its U-net

- Problem: Recall results are low, because a significant amount similar users are kept in similars users U-nets. How to increase the quality of the coverage ?

Clustering Useful Users*

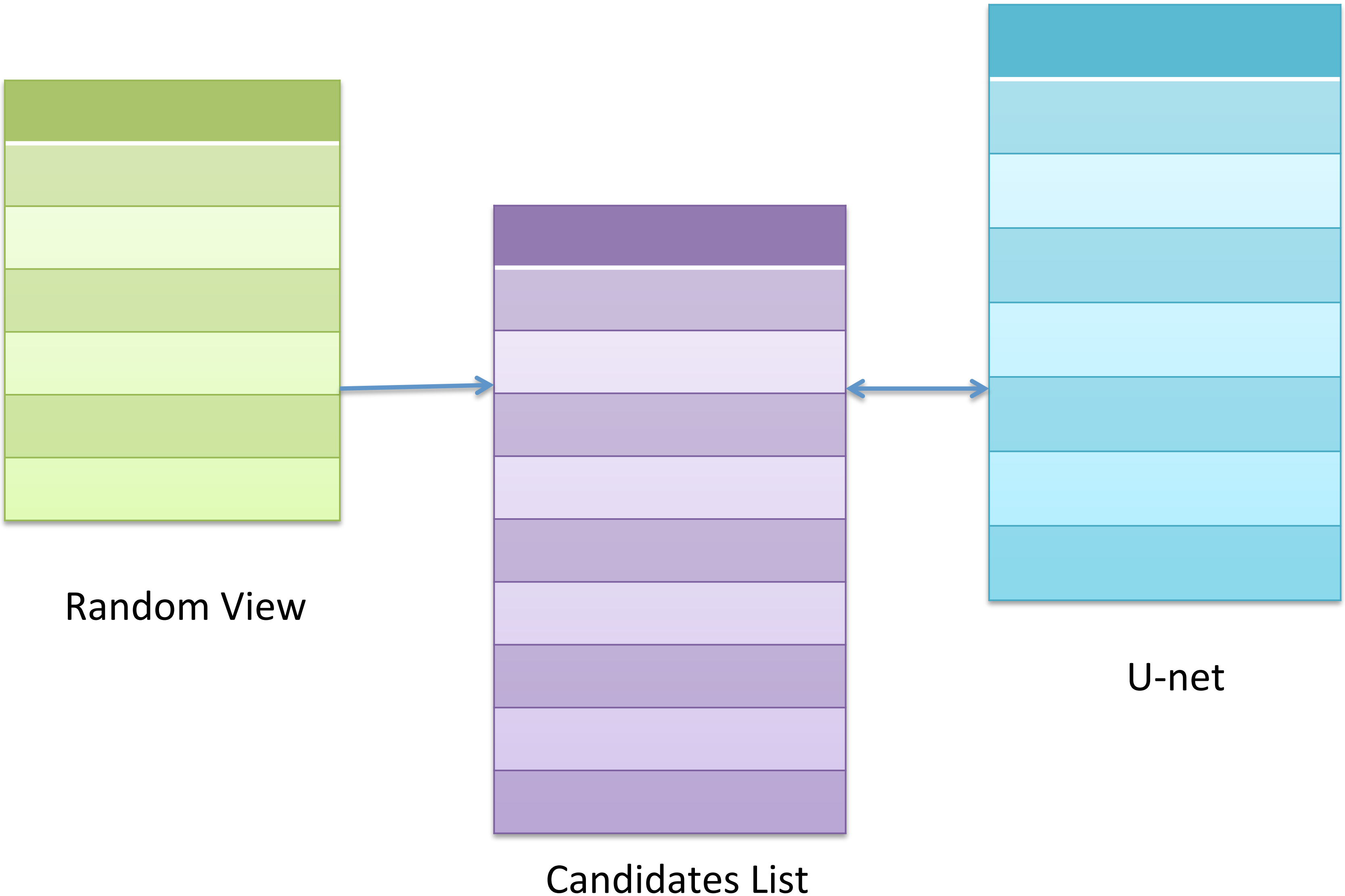
- What if we exploit **usefulness** instead of similarity ?
  - The usefulness of new user profile is determined based on the set of users profiles previously clustered in U-Net.
- At each epidemic, exchange, u_1 discovers new peers and computes **usefulness(U-net, profile(u_1), new profiles(u_i))**,

and keep only useful peers with best scores in u_i in U-net.

$$usefulness(v_j|v_{j+1}, ..., v_n) = rel(v_j) \times \prod_{i \in j+1,...,n} (1 - red(v_j, v_i))$$

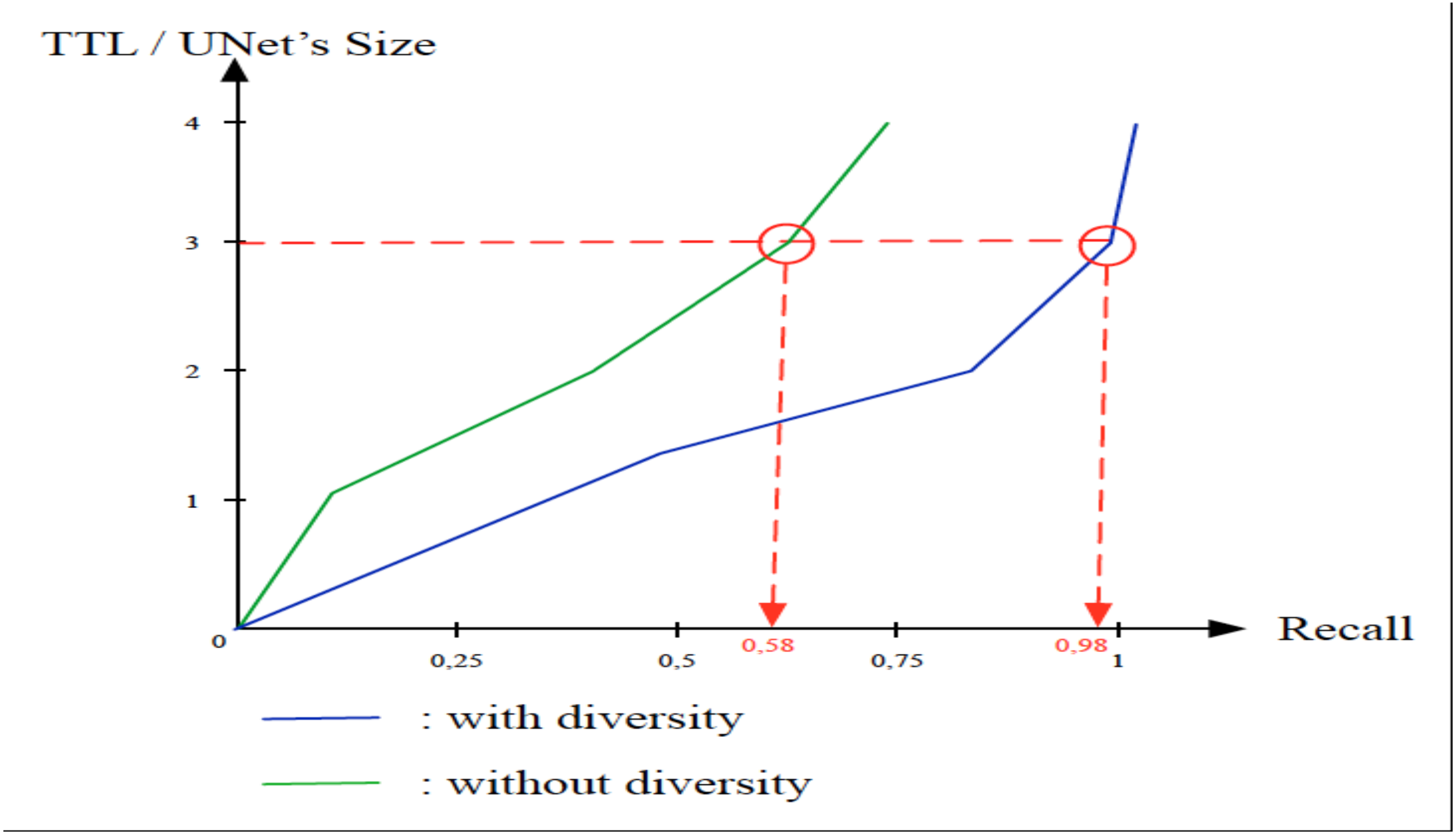
*[Servajean et al. Globe 14]

Dynamic Clustering Algorithm for Useful Users

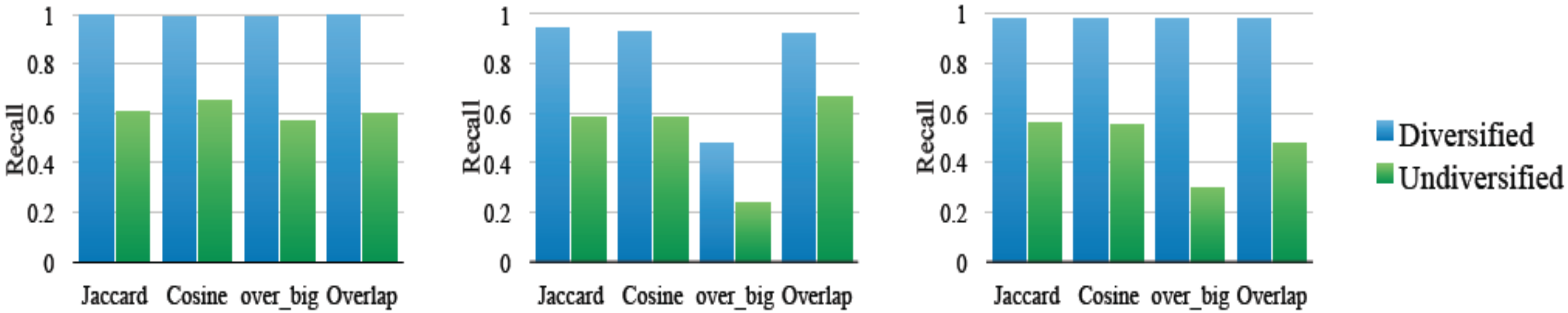


Experimental Results

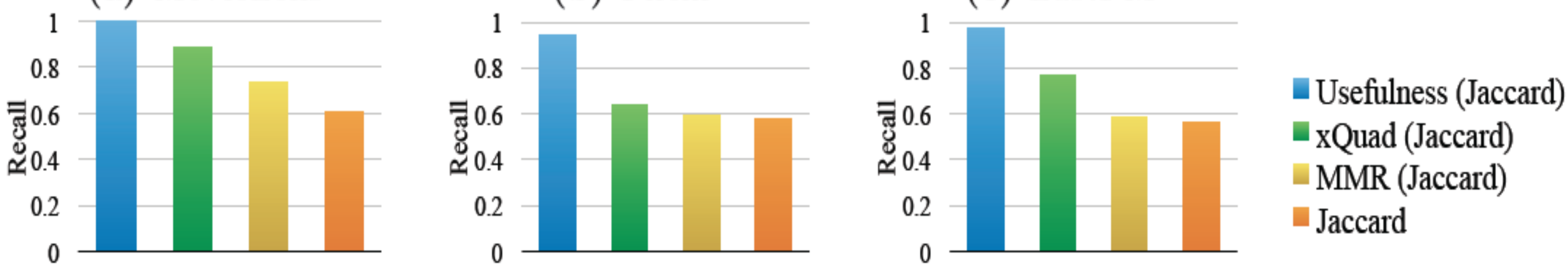
- Gains in Recall



Experimental Results



(a) MovieLens (b) Flickr (c) LastFM

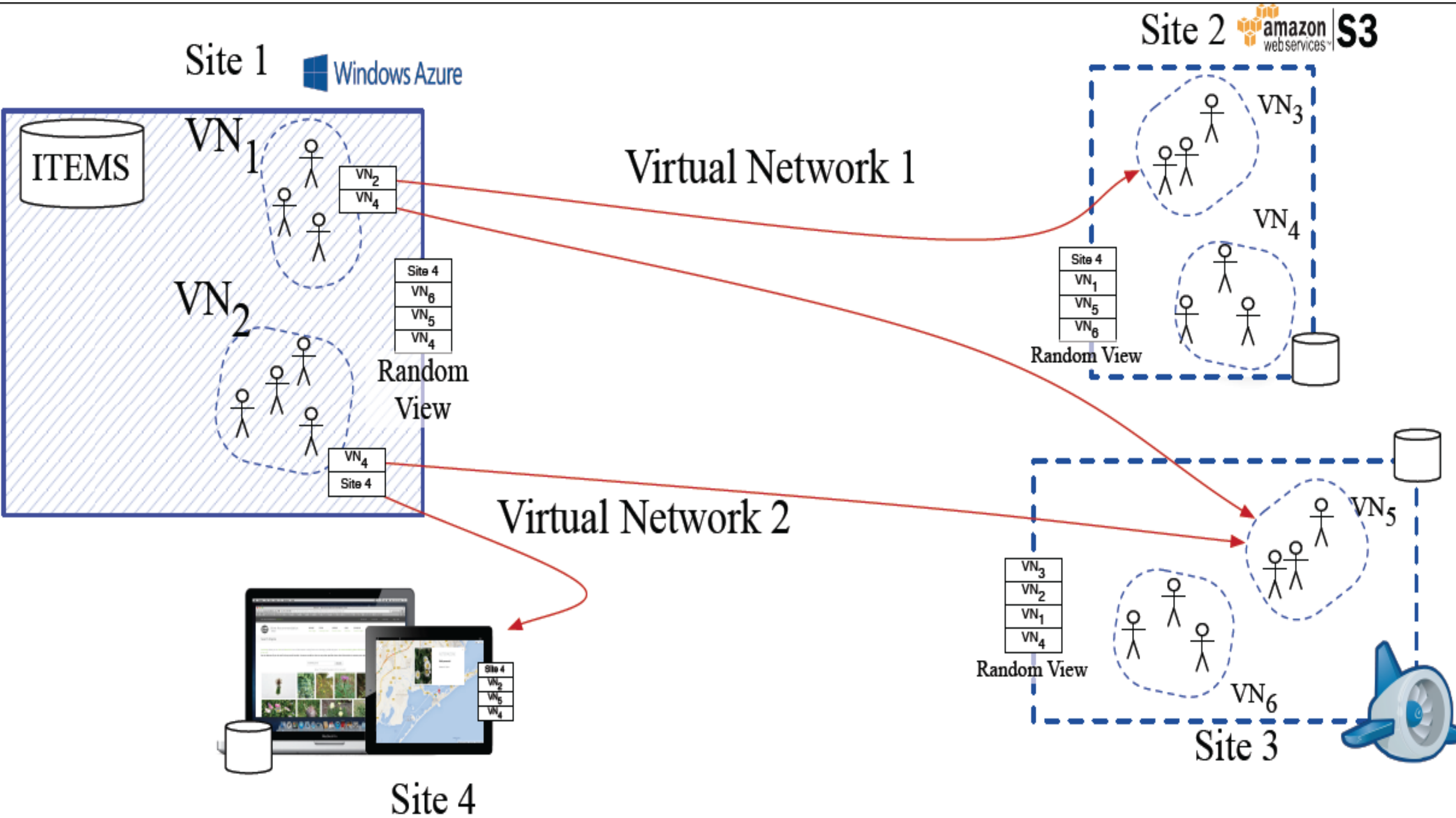


(d) MovieLens (e) Flickr (f) LastFM

TTL = 3

For details: [Servajean et al. Globe 14]

Diversity in Multi-Site Recommendation*



[Servajean et al. BDA 14]

Plant Recommendation Tool

Authentification

Type your username and password below

* Username

* Password

Log In

Forgot password ? Click here to reset

You do not have an account ? Register

Conclusion