



# User profile construction associated with a preferences database

First H.OUZIF <sup>1</sup>, Yassir AADIL <sup>2</sup> EL HOUCINE LABRIJI <sup>3</sup> Rachdi Mohamed<sup>4</sup>

<sup>1</sup>Laboratory of Technological Information and Modeling, University Hassan II, Casablanca, Morocco

<sup>2</sup>Laboratory of Technological Information and Modeling, University Hassan II, Casablanca, Morocco <sup>3</sup>Laboratory of Technological Information and Modeling, University Hassan II, Casablanca, Morocco

{ouzif.hind , aadil.yassir, rachdi.simo}@gmail.com,labriji@yahoo.fr

## Abstract:

The purpose of the user profile is to use the latter's preferences in order to personalize the responses to his requests and to carry out targeted recommendations.

A user profile can be built both manually or automatically, except that the manual way remains time consuming and complex for the user.

And that's the reason why we present in this article an automatic method based on data mining techniques.

The approach that we intend to suggest in this article consists of two main phases, the first consists of extracting the contextual preference rules, the second is the construction of the user profile which allows us to eliminate all the redundant and superfluous rules extracted from the first phase, the goal is to have a consistent and concise user profile.

A consistent user profile ensures that the preference rules defining the profile match the maximum of this user's preferences and contradict few of them.

A concise user profile implies that the profiles consists of a small number of preference rules.

In this article, we will mainly define the concepts used in order to understand the extraction problem that we intend to solve and define formalization of the problem.

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**Keywords:** User Profile, user profile building, personalized information access, context, Social Network...

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We validated our approach on a film database.

	mid	Title	Year	Genre	Director	Actor	Lang	Dur
$t_1$	$m_1$	Jumanji	1995	Act	Johnston, J.	Williams, R.	Eng	102
$t_2$	$m_2$	Grumpier Old Men	1995	Com	Matthau, W.	Deutch, H.	Eng	103
$t_3$	$m_3$	Waiting to Exhale	1995	Dram	Whitaker, F.	Hines, G.	Eng	105
$t_4$	$m_4$	Father of the Bride Part II	1995	Com	Shyer, C.	Martin, S.	Eng	108
$t_5$	$m_5$	Heat	1995	Act	Mann, M.	Pacino, A.	Eng	110
$t_6$	$m_6$	Sabrina	1995	Dram	Pollack, S.	Ford, H.	Fr	115
$t_7$	$m_7$	Tom and Huck	1995	Adv	Hewitt, P.	Thomas, J. T.	Eng	117
$t_8$	$m_8$	Sudden Death	1995	Act	Hyams, P.	Van Damme, J.C.	Eng	120
$t_9$	$m_9$	GoldenEye	1995	Adv	Campbell, M.	Brosnan, P.	Span	121
$t_{10}$	$m_{10}$	American President	1995	Rom	Reiner, R.	Douglas, M.	Eng	124
$t_{11}$	$m_{11}$	North	1995	Dram	Reiner, R.	Wood, E.	Eng	126
$t_{12}$	$m_{12}$	Copycat	1995	Dram	Amiel, Jon	Mulroney, D.	Eng	128

- **Lang** : Language
- **Dur** : Duration
- **com** : comedy
- **Act** : Actor
- **Dram** :Drama
- **Adv** : Adventure
- **Rom** : Romance

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**PROBLEM FORMALIZATION:**

We plan to organizethis item as follows:

The task of formalizing the extraction problem is divided into twosub-tasks: The first one is the1- Preference base and contextual extraction of the set S of preference rules from a Ipreferencerules preference base and the second is the2-Preference rules problem construction of user profile from I 'S. 3-User profile construction problem

Notation	Description
$S$	Ensemble des règles de préférences contextuelles
$I$	Un ensemble de littéraux appelés Items
$X$	Un itemset
$\mathcal{L}$	Le langage des itemsets
$D$	Une base de données transactionnelles
$P$	Une base de préférence
$\sigma$	seuil minimum de support
$\kappa$	seuil minimum de confiance
$\pi$	Une règle de préférence contextuelle
$\mathcal{CP}_{\sigma,\kappa}$	Un ensemble de règles de préférences contextuelles

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Figure 1 : Notions utilisées dans cet article

2 **PREFERENCE BASE AND CONTEXTUAL PREFERENCE RULES**

from the table below. The letters A, B, C, D and E represent respectively: Steven-Spiberg, Tom Hanks, Action, Leonardo Di caprio, and War. In this section, we will define and detail all the elements that will allow us to understand the An (item) set to A (attribute set) is a value-formulation of the extracting preferences' andattribute couple (Ai, A) such that Ai is an element building user profiles. The explanations that weof A and A dom(Ai). Table (a) contains the items will provide will be illustrated using the data(Director, A), (Actor, B), (genre, C), (Actor, D), and contained in the tables a, b and c (Genre, E). If no ambiguity is possible, we will

The letters in table (a) represent the values of simply note the items by their value. the Writer, Gender, Language, Type attributes

item	Valeur
$A$	Steven Spielberg
$B$	Tom Hanks
$C$	Action
$D$	Leonardo DiCaprio
$E$	War

(a) Signification des items



An item set is defined as follows: an itemset X identifiers will be designated by the set T. which defined on a set of attributes A is a set of items means that for each Itemset has a unique defined on A, which means that each item builds identifier (t1,...t5).

its own itemset. Table (b) contains 5 itemsets A transaction database D is a set of pairs which are: {A,C,D},{A,B,D}, {A,B,C,E}, {C,D},{A,B}. consisting of a transaction identifier «Tid » and We will now define what a transaction is. the transaction itself. Table (b) represents five

A transaction is an itemset designated by a transactions out of 5 items  $D = \{(t1, \{A, C, D\}), (t2, \{A, B, D\}), (t3, \{A, B, C, E\}), (t4, \{C, D\}), (t5, \{A, B\})\}$ .

Tid	Transactions				
t <sub>1</sub>	A		C	D	
t <sub>2</sub>	A	B		D	
t <sub>3</sub>	A	B	C		E
t <sub>4</sub>			C	D	
t <sub>5</sub>	A	B			

(b) Base de données transactionnelle

A preference base  $P \subseteq D \times D$  is a set of preference ht,  $UI \in P$ , t is called the preferred transaction pairs representing a sample of user transaction (for the user) and u is called the non-preferences on the base D. Intuitively, a user preferred transaction over t. Table(c) shows a set preference ht,  $UI \in P$  means that the user prefers of 5 user preferences denoted p1, . . . , p5.

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transaction t to transaction u. Given a user

Pid	Preference utilisateur
p <sub>1</sub>	$\langle t_1, t_3 \rangle$
p <sub>2</sub>	$\langle t_2, t_3 \rangle$
p <sub>3</sub>	$\langle t_2, t_4 \rangle$
p <sub>4</sub>	$\langle t_3, t_4 \rangle$
p <sub>5</sub>	$\langle t_4, t_5 \rangle$

(c) Base de préférences

In the figure below, we have tried to illustrate necessarily transitive. Contrary to the explicit the preference base and the transaction base. We collection, the implicit collection of data consists would like to point out that since the user in observing the user's behaviors and then preference base is collected implicitly, P is not extracting his preferences.

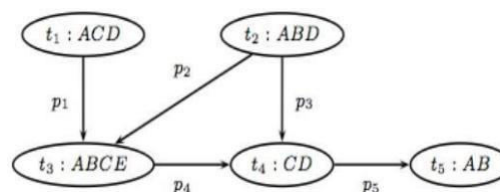


Figure 2 : graphe de préférences



To extract a user profile from the user-The ultimate goal is to build a user profile from the supplied preference base, the user is represented base of preferences he/she provided.

by a set of contextual preference rules verifying a This problem is subdivided into two sub-tasks, the number of properties of interest, a preference first consists of extracting all the minimal and rule is defined as follows: interesting contextual preference rules and the

Let us take the example of a context second consists of building a profile using the preference rule  $D E | AB$ , which indicates that if extracted rules. This support will be used as a two transactions contain the context  $AB$ , then the concept for the extraction of preference rules in transaction containing item  $D$  is preferred to the order to build a user profile one containing item  $E$ , in other words we choose

$D$  rather than item  $E$ . The interest of having a **3 PREFERENCE RULE EXTRACTION PROBLEM** contextual preference rule,  $i + i - | X$ , is the ability In this section we will present the extraction of to compare transactions. A transaction  $t$  is preference rules, we have defined, in an preferred to a transaction  $u$  according to  $\pi: i + i - | analogous way, the concept of support,  $X$  denoted  $t \pi u$ , if  $(X \{i +\} \subseteq t) (X \{i -\} \subseteq u) (i - \in / t)$  confidence, and minimality as interesting criteria  $(i + \in / u)$ , where  $X$  is an itemset of  $L$ ,  $i +$  and  $i -$  are to eliminate uninteresting contextual preference items of  $L \setminus X$ . For example, the  $ACD$  transaction is rules. We considered the example presented in preferred to the  $ABCE$  transaction according to tables (a) (b) and (c), The contextual preference the contextual preference rule  $D E | A$ . rule  $D E | A$  is more interesting than  $D E | B$$

A contextual preference rule  $\pi$  agrees with a because  $D E | A$  agrees with two preferences ( $p_1$  user preference  $ht$ ,  $UI \in P$  if the preference rule  $\pi$  and  $p_2$ ) while  $D E | B$  agrees with only one user leads to preferring  $t$  to  $u$ . The agreement of a preference ( $p_2$ ). This information is provided by contextual preference rule  $\pi$  in  $P$  is defined as supporting a contextual preference rule  $\pi$  that agree( $\pi, P$ ) = { $ht, UI \in P | t \pi u$  estimates the probability that

$\pi$  agrees with a pair  $P$ .

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$$supp(\pi, P) = \frac{|agree(\pi, P)|}{|P|}$$

This information is provided by supporting a A set of preference rules is evaluated by its contextual preference rule  $\pi$  that estimates the cardinality while the consistency of a set of rules probability that  $\pi$  agrees with a pair  $P$ . is evaluated by a cost function.

#### 4 USER PROFILE BUILDING PROBLEM

We will define the notions of agreement, contradiction and coverage on a set of contextual preference rules  $\Pi$ .

The goal of this section is to present the preference rules  $\Pi$ . Let  $P$  be a preference base and a set of contextual preference rules extracted in the contextual preference rules  $\Pi$ . The set of user preferences in accordance with  $\Pi$  is defined as follows:

$$agree(\Pi, P) = \cup_{\pi \in \Pi} agree(\pi, P)$$

Let  $P$  be a preference base and a set of Let there be a preference base  $P$  and a set of contextual preference rules  $\Pi$ . The set of user contextual preference rules  $\Pi$ . The set of user preferences in accordance with  $\Pi$  is defined as preferences covered by  $\Pi$  is defined as follows:

$$contradict(\Pi, P) = \pi \in \Pi contradict(\pi, P) \quad cover(\Pi, P) = agree(\Pi, P) \quad contradict(\Pi, P)$$



Given a preference base  $P$  and a set of contextual preference rules  $\Pi$ , the cost of  $\Pi$  according to  $P$  denoted  $Cost(\Pi, P)$ , is defined as:

$$Cost(\Pi, P) = \frac{|P \setminus cover(\Pi, P)| + |contradict(\Pi, P)|}{|\Pi|}$$

We consider that the user profile is consistent if its cost is minimal, knowing that the cost of a user profile  $\Pi$  represents the percentage of preferences in  $P$  which is not covered by any rule in  $\Pi$  or which is in contradiction with some rules in  $\Pi$ .

A user profile is built from data from a preference base  $P$  and a set of contextual preference rules  $S$ , select a profile  $\Pi \subseteq S$  that minimizes cost and is concise.  $\Pi$  is called the user profile associated with  $P$ .

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## 5 CONCLUSION

In this article we have presented the formulation of the user profile construction problem, as well as the extraction of preference rules based on a preference data base, in order to build an adequate user profile.

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