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A Review of Personal Profile Features in Personalized Learning Systems

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Abstract. This paper reviews literature, market reports and commercial sites in order to identify features of personal profiles. This is a preparatory step in the development of a personalized learning environment. Results indicate that several features can be included as long as they relate to use cases. We also found that privacy concerns might arise when dealing with personal profiles and measures should be taken to ensure compliance with policies and legislation on the topic and to avoid the risk of alienating users.

Keywords: Personal profiles · Personalized learning

1. Introduction

According to the National Educational Technology Plan developed by the U.S. Department of Education [1], "Personalized learning refers to instruction in which the pace of learning and the instructional approach are optimized for the needs of each learner. Learning objectives, instructional approaches, and instructional content (and its sequencing) may all vary based on learner needs. In addition, learning activities are meaningful and relevant to learners, driven by their interests and often self-initiated."

It was also found that personalized learning systems can enhance learning effectiveness and motivate learners [15]. Personalization depends on information collected from the learner and stored in a personal profile. There are several information elements relevant to personal profiles, from manually entered personal interests and preferences, to automatically collected keystrokes, cursor movements, and navigation histories. This paper reviews the literature on personal profiles to inventory the various elements that compose a personal profile. It also discusses privacy concerns and some measures used to alleviate them.

This review is a preparatory step in the development of a personalized learning environment that provides personalized learning resource recommendations to the users. This work is conducted under the Learning and Performance Support Systems program (LPSS) at the National Research Council of Canada (NRC). NRC's LPSS program, by implementing adaptive and personalization strategies, develops software components for learning, training, performance support, and enterprise workforce optimization.

2.   Methods

Our article integrates material gathered through a literature review, a market report review, and a review of personal profiles on some commercial sites. Articles to review were identified through the Scopus scientific database with "personal profile"-related search strings limited to articles published after 2008. The final subset of articles analyzed included 271 scholarly articles and an additional 13 market reports. Finally, we reviewed seven commercial sites that use personal profiles.

3.   Results

The results of our review indicate that multiple information fields can populate a personal profile. Information can be collected either manually by asking the user to fill all or some parts of the user profile, or automatically by monitoring systems that observe user behaviors, the environment, or both. A summary of the personal profile fields extracted from literature is presented.

3.1.   Literature review

The literature review revealed multiple types of personal profiles, including those created through manual entry, automatic entry, and mixed entry. In addition, some personal profile field values can be inferred or computed from other field values or other sources of data (e.g. clickstream) [2].

Table 1. Summary of the personal profile fields based on the literature review.

Authors	Technology	Profile fields
Adomavicius, 2011 [2], Drachsler et al., 2015 [7], Verbert, 2012 [25]	**Context aware recommender systems for learning**	- basic personal information- identification information, name, contact information, affiliations, authentication information, information on accessibility, including language capabilities and disabilities, gender, age, profession, and educational level - social relations, contain information about friends, enemies, neighbors, coworkers, relatives, and communities - affective, emotional and sentiment information -prior knowledge or performance information - user schedule information - available time of the learner - user ratings - user-entered interests and preferences - user interests inferred from user activity - user-entered learning goals - user-entered learning and cognitive styles – visual, textual, or auditory, and many more - user interaction history - current activity or task - timestamp - location, through GPS, Wi-Fi location sensors, or manually entered. - physical conditions: noise level, lighting, motion, etc., captured by sensors - user's current device and its state to recommend appropriate learning resources

Authors	Technology	Profile fields
Ferreira-Sattler, 2012 [9], Klasnja-Milicevic et al., 2011 [14] Porcel, 2010 [22]	Technology to personalize learning recommendations	- user's previous selection of learning objects (LOs) - user's learning style (entered during registration) - last name, first name, login, previous knowledge, preferences, etc. (known as static information) - information about interests, dominant meaning words, and behavior (known as dynamic information) - user preferences on collaboration possibility with other users
Berrocal et al., 2015 [3], Conti et al., 2015 [5], Have-liwala, 2012 [12], Pang et al., 2015 [21]	Advertising, marketing companies creating sociological profiles of the users, targeted ads	- user interactions via mobile services - user location - inferred personal information from Google personal profiles - browsing history - prior searches by the user - prior search results - demographic information about user - location - user personality information - user's preferred topics - information extracted from websites frequently accessed by the user
Bertini et al., 2013 [4]	Video, interest and friend recommendations	- Facebook profile info - user activity on Facebook
Dehghani et al., 2016 [6]	Content customization	- extended user profile is used to improve content customization based on user's group memberships
Elmisery et al., 2016 [8]	Social recommender system	- the profile is a list of video content the user has watched and/or purchased and the metadata extracted from it regarding content (directors, actors, genres, etc.) and the ratings users gave to the content

Authors	Technology	Profile fields
Hella et al., 2010 [13], Lofi et al., 2015 [18]	Recommender systems	- personal information - name, birth date and address - stable interests - temporary interests - seed set rating (to compute recommendations)
Lee et al., 2014 [16]	Personalized news recommendations	- utilizing tweets, retweets and hashtags to extract keywords to build the personal profile
Maleszka et al., 2013 [19]	Hybrid collaborative filtering applications	- generating group profile by merging profiles for the group of users
Nanda et al., 2014 [20]	Collaborative filtering	- browsing history of the user - search keywords
Soleymani, Dous, and Pun, 2009 [23]	Affective retrieval system	- the user's personal profile (gender, age, cultural background) is employed to improve the collaborative filtering in retrieval. -the user registers a new profile, the system retrieves the query "both by emotional keywords and arousal and valence."
Valentin, et al., 2014 [24]	Recommender systems that support employees in daily tasks	- analyzing usage behavior & usage gaps - text entries created by the users
Wang et al., 2015 [26]	Social networking sites - profile portals	- personal skill information - academic and business backgrounds - social connections

Authors	Technology	Profile fields
Wang et al., 2015 [28]	**Social media**	- models connections of sentences within social context information (example – work and education fields) and ranks according to uniform graph, extracts important sentences to create personal profile summaries collectively
Wang et al., 2014 [27]	**Mobile social networking in proximity**	- proximity areas
Wusheng et al., 2015 [29]	**Context-aware service systems**	-user position -personal profile -historical records

3.2. Commercial review

The commercial review revealed multiple types of personal profiles, including those created through manual or automatic entry.

Table 2. Profile fields from various commercial systems.

Commercial system	LinkedIn, **Professional profile, job search and learning platform**	
URL	https://www.linkedin.com	
Personal Profile Fields		
Name	Education	Groups
Summary	Skills & endorsements	Following
Language	Organizations	Users can also add media, document, photo, link, video and presentation
Experience	Volunteer	

Commercial system	Google, **Search engine**	
URL	**https://www.google.com**	
Personal Profile Fields		
List of visited websites	Number of times the user went to the website	**Manual (when users sign in with profile)**
Websites topics	Geo-location of the user IP address (if available)	Age
Webpage referral	Visualized advertisements and number of clicks on them	Gender
Time spent on each website		Language

Commercial system	Degreed, **Lifelong learning platform**	
URL	**https://degreed.com**	
Personal Profile Fields		
Name	Learning goal	Social – link to social accounts in Degreed profile
Bio	Privacy settings - visibility to the public	Integration setting – ability to bring learning records from some learning sites
Location	Email settings	

Commercial system	D2L Brightspace, **Personalized learning platform**		
URL	**https://www.d2l.com**		
Personal Profile Fields			
Name	Hometown	Picture	
Nickname	Homepage	Social networks	

Commercial system	Facebook, **Social networking site**		
URL	**https://www.facebook.com**		
Personal Profile Fields			
Name	Religious views	Places (towns) you have lived in	
Date of birth	Political views	Family and relationships	
Email	Public key	Summary	
Mobile phone number	Websites	Nickname, birth name	
Gender	Social links	Favorite quotes	
Sexual Orientation	Lives in (Town)	Life events	
Languages	Work and education	Privacy settings	

Commercial system	GCconnex, **Govt of Canada employees collaboration site**	
URL	**htpps://gcconnex.gc.ca**	
Personal Profile Fields		
Name	About me - Summary	Skills
Your department	Education	Second language evaluation
Email address	Work experience	Opt in – opting in to participate in different programs

Commercial system	Twitter, **News and social networking site**	
URL	**https://twitter.com**	
Personal Profile Fields		
Name	Website	Followers
Twitter account name	Birthday	Like
Profile photo	Date joined	Moments
Header photo	Photos and videos	Who to follow
Bio	Tweets	
Location	Following	

In practice, we see that commercial systems collect a plethora of information in a personal profile. We will now discuss the possible impact on user privacy.

4.   Privacy Issues

Our review revealed that privacy issues are unavoidable when collecting data to populate personal profiles. Below, we discuss those privacy concerns and some measures used to alleviate them.

"Personalization that is not kept in context crosses the line to become "creepy" and will result in consumer distrust, which could thwart personalization initiatives or trigger government regulations regarding the use of customer data. Sellers must incorporate privacy regulations into their personalization strategies or run the risk of alienating their customers" [11].

Some examples of privacy concerns with personal profiles include targeted ads that infer personal information from Google personal profiles (see Table 2). Conti and colleagues [5] discuss significant privacy issues with such targeted advertising services. Privacy issues include privacy violations when the user's data are gleaned from targeted ads and connected with navigation behavior. Such data could be collected and sent to 3rd party websites without the users' explicit consent. To alleviate privacy concerns, there are some privacy preserving ad systems which present targeted ads where users cannot be tracked by ad networks. Two examples include Privad and Adnostic, were the users' information stays client side and ads are selected locally [5].

In order to alleviate privacy concerns, personal profiles technology developers should comply with internal privacy policies within their organizations. They should also check to make sure the information they collect respect the privacy regulations and legislations in effect in their jurisdictions. In addition, information about data security and privacy protection should be available to users. Elmisery at al. [8] note that users will provide more truthful data about themselves if they are informed about privacy measures beforehand and are assured that their privacy will be preserved.

5.   Conclusion

Our review of personal profile features demonstrates that information to populate a personal profile is collected about an individual, either by asking directly, by observing an individual's actions, or sometimes computed or inferred from various sources of data. Collecting personal information could raise privacy concerns that have to be addressed. Before starting to build a personal profile, one must determine particular use cases that need to be addressed [10, 15]. The use cases will then determine which features must be included as part of the personal profile for a service or an application. Finally, the best way to obtain the information needed must be determined.

References

1. U.S. Department of Education, Office of Educational Technology: National Education Technology Plan Update, January 2017. https://tech.ed.gov/netp
2. Adomavicius, G., Tuzhilin, A.: Context-Aware Recommender Systems. Chapter 7 In Recommender Systems Handbook, Springer US, pp. 217--253 (2011)
3. Berrocal, J., Canal, C., Garcia-Alonso, J., Makitalo, N., Mikkonen, T., Miranda, J., Murillo, J. M.: Smartphones as Personal Profile Providers: Enhancing Mobile App Architectures. Proceedings of the 2nd ACM International Conference on Mobile Software Engineering and Systems (MOBILESoft 2015), pp. 134--135 (2015)
4. Bertini, M., Del Bimbo, A., Ferracani A., Gelli, F., Maddaluno, D., Pezzatini, D.: Socially Aware Video Recommendation using Users' Profiles and Crowdsourced Annotations. Proceedings of the 2nd International Workshop on Socially-Aware Multimedia (SAM 2013) - Co-located with ACM Multimedia 2013, pp. 13-17 (2013)
5. Conti, M., Cozza V., Petrocchi, M., Spognardi A.: TRAP: using TaRgeted Ads to unveil Google personal Profiles. Proceedings of IEEE International Workshop on Information Forensics and Security (WIFS 2015), 6 pages (2015)
6. Dehghani, M., Azarbonyad, H., Kamps, J., Marx, M.: Generalized Group Profiling for Content Customization. ACM Conference on Human Information Interaction and Retrieval (CHIIR 2016), pp. 245--248 (2016)
7. Drachsler, H., Verbert, K., Santos, O. C., & Manouselis, N.: Panorama of Recommender Systems to Support Learning. In Recommender Systems Handbook, Springer US, pp. 421--451 (2015)
8. Elmisery, A. M., Seungmin, R., Botvich, D.: Collaborative Privacy Framework for Minimizing Privacy Risks in an IPTV Social Recommender Service. Multimedia Tools and Applications, pp. 14927--14957 (2016)
9. Ferreira-Satler, M., Romero, F.P., Menendez-Dominguez, V.H., Zapata, A., Prieto, M.E.: Fuzzy Ontologies-Based User Profiles Applied to Enhance E-Learning Activities. Soft Computing 16 (7), pp. 1129--1141 (2012)
10. Gartner Report.: Three Steps to Yield the Most Value From Your Customer Data Using Analytics, Published: 12 May 2016 (2016)
11. Gartner Report.: Hype Cycle for Personal Technologies, 2016, Published: 26 July 2016 (2016)
12. Haveliwala, T.H., Glen, G.M., Kamvar, S.D.: Targeted Advertisements Based on User Profiles and Page Profile, Patent No. US 8,321,278 B2, US Patent Office (2012)
13. Hella, L., Krogstie, J.: A Structured Evaluation to Assess the Reusability of Models of User Profiles. In Enterprise, Business-Process and Information Systems Modeling. Springer Berlin Heidelberg, pp. 220--233 (2010)
14. Klasnja-Milicevic, A., Vesin, B., Ivanovic, M., Budimac, Z.: E-Learning Personalization Based on Hybrid Recommendation Strategy and Learning Style Identification. Computers & Education, 56(3), pp. 885--899 (2011)
15. Lapointe, J.-F., Molyneaux, H., Kondratova, I., Freixanet Viejo, A.: Learning and Performance Support - Personalization Through Personal Assistant Technology. In: P. Zaphiris and A. Ioannou (eds.): LCT 2016, LNCS, vol. 9753, pp. 223--232. Springer (2016)
16. Lee, W.-J., Oh, K.-J., Lim, C.-G., Choi, H.-J.: User Profile Extraction from Twitter for Personalized News Recommendation. 16th International Conference on Advanced Communication Technology: Content Centric Network Innovation (ICACT 2014), pp. 779—783 (2014)
17. Levy, J.: UX Strategy – How To Devise Innovative Digital Products That People Want. O'Reilly Media. (2015)
18. Lofi, C., Nieke, C.: I Would Like to Watch Something Like 'the Terminator': Cooperative Query Personalization based on Perceptual Similarity. 18th International Conference on Extending Database Technology (EDBT 2015), pp. 533--536 (2015)

19. Maleszka, M., Mianowska, B., Nguyen, N.T.: A Method for Collaborative Recommendation Using Knowledge Integration Tools and Hierarchical Structure of User Profiles. Knowledge-Based Systems, 47, pp. 1--13 (2013)
20. Nanda, A., Omanawar, R., Deshpande, B.: Implicitly Learning a User Interest Profile for Personalization of Web Search Using Collaborative Filtering. Proceedings of IEEE/WIC/ACM International Joint Conferences on Web Intelligence (WI) and Intelligent Agent Technologies (IAT), pp. 54—62 (2014)
21. Pang Y, Wang B, Wu F, Chen G, Sheng B.: PROTA: A Privacy – Preserving Protocol for Real-Time Targeted Advertising. 34th IEEE International Performance Computing and Communications Conference (IPCCC 2015) 8 pages (2015)
22. Porcel, C., Herrera-Viedma, E.: Dealing with Incomplete Information in a Fuzzy Linguistic Recommender System to Disseminate Information in University Digital Libraries. Knowledge-Based Systems, 23(1), pp. 32--39 (2010)
23. Soleymani, M., Dous, J., Pun, T.: A Collaborative Personalized Affective Video Retrieval System. Proceedings of the 3rd International Conference on Affective Computing and Intelligent Interaction and Workshops (ACII 2009), 2 pages (2009)
24. Valentin, C.D., Emrich A., Werth, D., Loos, P.: Context-Sensitive and Individualized Support of Employees in Business Processes: Conceptual Design of a Semantic-Based Recommender System. Proceedings of the 9th International Workshop on Semantic and Social Media Adaptation and Personalization (SMAP 2014), pp. 77--82 (2014)
25. Verbert, K., Manouselis, N., Ochoa, X., Wolpers, M., Drachsler, H., Bosnic, I., Duval, E.: Context-Aware Recommender Systems for Learning: a Survey and Future Challenges. IEEE Transactions on Learning Technologies, 5(4), pp. 318--335 (2012)
26. Wang, H., Wu, J.: Optimizing Seed Set for New User Cold Start. IEEE Symposium Series on Computational Intelligence (SSCI 2015), pp. 957--962 (2015)
27. Wang, Y., Xu, X.: Overview on Privacy-Preserving Profile-Matching Mechanisms in Mobile Social Networks in Proximity (MSNP). Proceedings of the 9th Asia Joint Conference on Information Security (AsiaJCIS 2014), pp. 133--140 (2014)
28. Wang, Z., Shoushan, L., Zhou, G.: Personal Summarization from Profile Networks. Frontiers of Computer Science, pp 1--13. (2015)
29. Wusheng W, Weiping L, Zhonghai W, Zhichao Z .: Petri Net-Based Context-Aware Service System Modelling: An Overview. Proceedings of the 2014 International Conference on Service Sciences (ICSS 2014), pp. 60--65 (2015)