

Formal and Informal Approach for E-learning

¹Kinjal Patel & ²Pariza Kamboj

^{1,2} Computer Engineering Department, Sarvajani College of Engineering and Technology, Athwalines, Surat, Gujarat (India)

ARTICLE DETAILS

Article History

Published Online: 16 June 2018

Keywords

E-learning, Web Mining, Learning Management System, Personalized Learning Environment, Formal Approach, Informal Approach

Corresponding Author

Email: kinjalvpatel95[at]gmail.com

ABSTRACT

Web mining Web mining is the application of data mining which focuses on discovering usage patterns from web logs and web data. Web data has the properties like unstructured nature of data, dynamic, diverse, huge amount of data to name a few. Due to which web data research has experienced a lot of challenges, such as scalability, multimedia compression and temporal issues like extraction of information from a plethora of data. As a result, web users always stuck up into a huge amount of unstructured data and face the problem of information overload while interacting with the web. The applications of web mining include e-services like e-commerce, e-governance, e-learning, e-market, e-finance, e-banking to name a few. In this paper, the focus is on e-learning. E-learning is the use of technology to enable people to learn anytime and anywhere. E-learning can include training, the delivery of just-in-time information and guidance from experts. There are two types of learning systems namely the Learning Management System (LMS) and the Personalized Learning Environment (PLE). These two systems are also called formal and informal approach for learning respectively. In this paper, a survey on these two systems and a comparison based on various parameters has been provided.

1. Introduction

With the quick and unstable growth of information available over the Internet, World Wide Web has become a powerful platform to store, disseminate and retrieve information as well as to mine useful knowledge [1]. Web data has the properties like unstructured nature of data, distributed, heterogeneous, dynamic, diverse, huge amount of data to name a few. Web data research has experienced a lot of challenges, such as scalability, multimedia compression and temporal issues like extraction of information among others [2]. There are many problems in web related search. Some of them are 1) Finding relevant information, 2) Finding needed information, 3) Learning useful knowledge, and 4) Personalization of information to name a few [2] [11].

A. Characteristics of Web Data

The data on the web has its own distinctive features compared to the data in conventional database management systems. Web data usually exhibits the following characteristics [3][4]:

The data on the web is huge in amount: Currently, it is hard to estimate the exact data volume available on the Internet due to the exponential growth of web data every day. The enormous volume of data on the web makes it difficult to handle web data via the traditional database techniques.

The data on the web is distributed and heterogeneous: The essential property of the web, an interconnection of various nodes over the internet located geographically apart leads to generation of web data that is usually distributed across a wide range of computers or servers around the world [3]. This nature of web leads to the requirement of

developed techniques for web data processing with the ability of dealing with heterogeneity of data.

The data on the web is unstructured: Web pages need not follow any rigid and uniform data structures or schemas unlikely to the conventional database management. Instead, web designers are able to arbitrarily organize related information together on the web in their own ways, as long as the information arrangement meets the basic layout requirements of web documents, such as HTML format. As a result, there is an increasing requirement to better deal with the unstructured nature of web documents and extract the mutual relationships hidden in web data for facilitating users to locate needed web information or service.

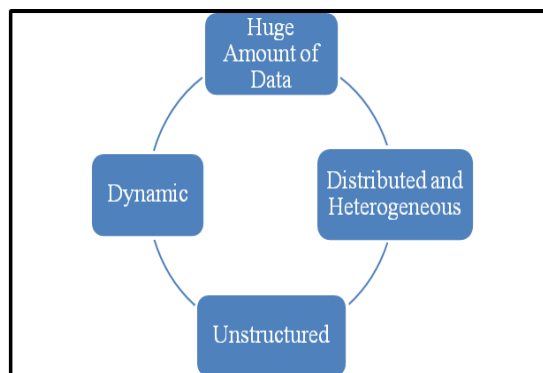


Figure 1: Characteristics of Web Data [3]

The data on the web is dynamic: The implicit and explicit structure of the web data is updated. A variety of presentations of web documents are generated especially due to contents updation by different applications of web based data management systems. As a result, dangling links and relocation problems will be produced when domain or file names change or disappear. This feature leads to frequent schema

notifications of the web documents, which often hampers the traditional information retrieval.

B. Structure of Web Mining

Web data mining is classified into three categories: Web content mining, Web structure mining, and Web usage mining [7].

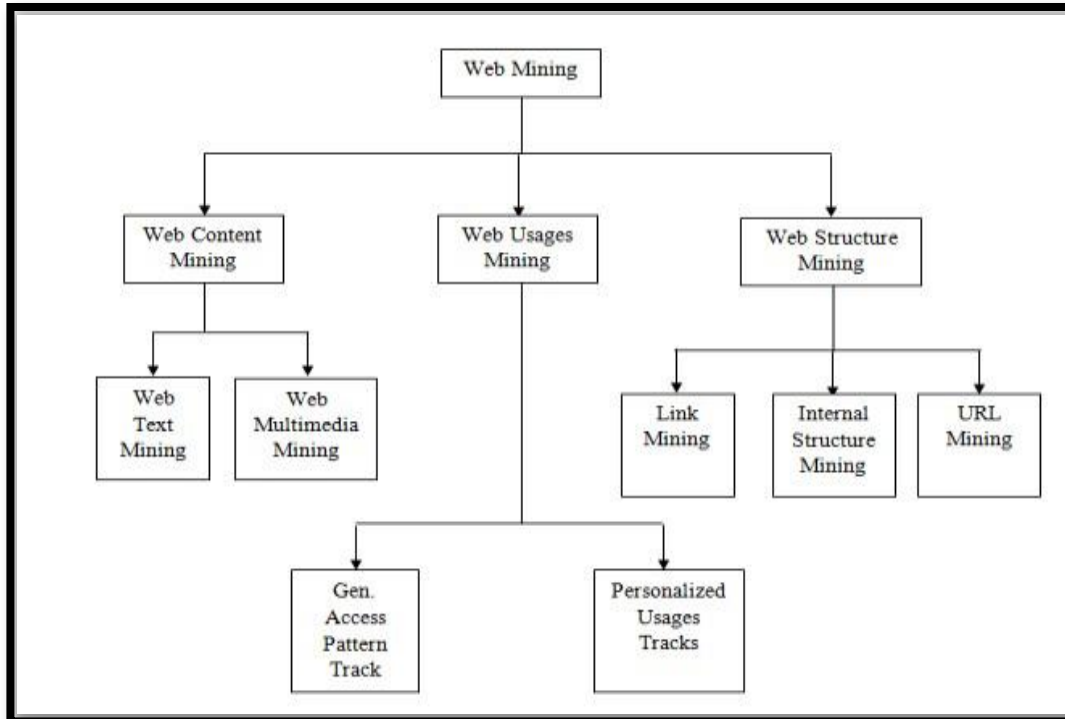


Figure 2: Structure of Web Mining [7]

1. Web Content Mining:

It refers to mining the E- contents of web pages. Web content mining is an automatic process that extracts patterns from data, web contents, and documents, such as the HTML files, images, or E-mails [7].

2. Web Structure Mining:

Web structure mining is the analysis of the link structure of the web, and their purpose is to identify more preferable documents [7].

3. Web Usage Mining:

Web usage mining is the automatic discovery of user access patterns from web servers [7].

C. Application of Web Mining

Different applications of web mining include e-services like e-commerce, e-governance, e-learning, e-finance, e-banking to name a few.

E-learning is the use of technology to enable people to learn anytime and anywhere. There are two types of e-learning system namely Learning Management System and Personalized Learning Environment [4]. Learning Management System (LMS) provides formal learning support. It is a static system that uses one-size-fits for all. It is content centric and has a pre-defined set of tools. While Personal Learning

Environment (PLE) supports informal learning. It is learner interactive system and also works in collaborative manner. It is student centric and flexible. The e-learning can be made more personalized using web content mining and web usage mining.

The rest of the paper is structured as follows. Section 2 discusses different approaches for e-learning. The parametric evaluation of different e-learning systems is presented in Section 3. The concluding remark is given in Section 4.

2. Different approaches for e-learning

E-learning’s general concept is essentially learning which involves the usage of any electronic device, from computers to mobile phones, and which might, or might not, involve the usage of the internet (Web sites+ other applications) or an intranet (Local network system) [6]. There are two types of e-learning systems. 1) Synchronous Learning and 2) Asynchronous learning. Synchronous learning includes virtual classrooms and virtual learning environment. While asynchronous learning includes traditional learning. LMS and PLE, two categories of e-learning systems are described in the following subsections [4].

A. Learning Management System

LMSs are known by various names: Course Management System (CMS), Learning Content Management System (LCMS), Virtual Learning Environment (VLE), and Virtual Learning System (VLS). An LMS is defined as “Software (web) application used to plan, implement, and assess learning process.” An LMS provides an instructor or moderator with a

way to create and deliver content, monitor learner participation, and assess performance [6].

There are three main types of LMSs: (a) Proprietary LMSs, (b) Open-source LMSs, and (c) Cloud based LMSs [20]. Proprietary LMSs have been licensed by developers so the goals of the proprietary LMSs are Blackboard, and eCollege. Open source LMSs source code has been made available to the public and can be used free of charge. Example of open-source LMSs are Canvas, Moodle, and Sakai. Cloud based LMSs have been introduced as a convenient and low-cost way of using an array of cloud based tools in higher education institutions. For instance, Google Drive can be used for document sharing and collaboration, Dropbox for file storages, Skype for a communication tool, Flickr for photo sharing, and YouTube for useful video sharing. Examples of cloud based LMSs are Amazon Web Service and Talent LMS.

LMS is a software environment designed to manage user learning interventions as well as deliver learning content and resources to students. It has also been stated that “the LMS is a set of tools and a framework that allows the relatively easy creation of online course content and the subsequent teaching and management of that course including various interactions with students taking the course” [6]. According to some study,

LMS consists of pedagogical devices, human interactions, learning contents and assessment, supporting and advancing traditional learning in school or in higher education [6]. LMS is a useful content distribution system, where instructors can distribute course materials and interact with students at a distance.

LMS can also be described as a high level web based technology solution for planning, conveying and managing of learning events within an organization such as online, virtual classroom and instructor-led courses that can assess a specific learning process. LMS is one of the solutions which are useful for both students and instructor in online learning environment. LMS provide tools for student communication and interaction among students and instructors. LMS supports the interaction by means of thread discussions, shared files and forums. LMS also support management task such as delivery and tracking, examination, planning, virtual live classes and several statistical analyses. The goal of an LMS is to keep track of student's progress and performance. LMS is not just viewed as an instructional trend but as a tool that benefits the adopters as well. As a web based learning tool, LMS facilitates “any time, any place” access to learning content and management [6].

Issues in LMS

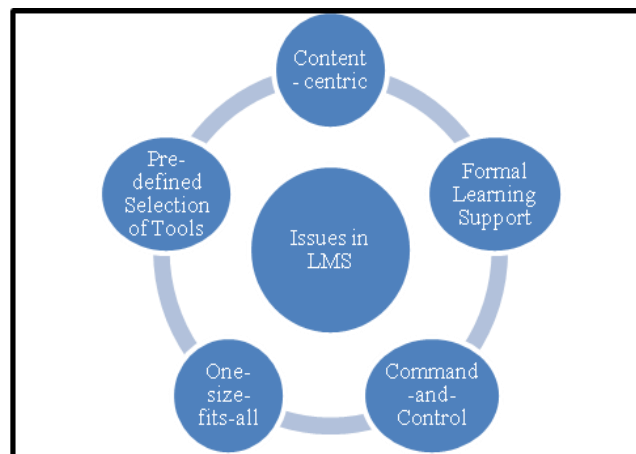


Figure 3: Issues in LMS [5]

B. Personalized Learning Environment

‘One size fits all’ approach characteristic of the LMS makes it insufficient to meet the varied needs of learners [5]. To overcome this restriction of LMS, PLE was realized. A personal learning environment (PLE) is a solution for keeping up with the rapid pace of knowledge change [21]. In fact, there are situations where PLE is not a single piece of software, rather a collection of tools used by users to meet their needs as part of their personal learning routine. Characteristics of the PLE design includes a) Learning with same interest people b) Controlling the learning resources c) Managing the participation d) Integration of individuals learning. These characteristics may be achieved using a combination of existing devices, tools, applications, communities and services.

In contrast to LMSs which uses mostly course centered view of learning, PLEs uses a learner-centric view of learning, allowing learners to improve their learning process. Authors in

[5] proposed a PLE based on tools, communities and services inspired from recent technologies (namely Web 2.0, social networks, etc.). They enhanced the individual's educational platforms by incorporating feedback and guidance as recommendations into learning activities and putting learners in-charge of their learning process to help them learning the best.

PLE is an online learning environment which provides for each learner his/her own learning plan and defines the best learning paths according to his/her preferences, interests and knowledge. Learners set their own goals, take control of and manage their own learning content as well as process. This leads to defining the best collaborators and the relevant resources that better fit his/her needs. Also, the weaknesses of learners can be recognized and the personalization is improved upon by revising the contents.

Personal Reader Framework (PRF) makes use of recent semantic web technologies for realizing a service-based

environment for personalized e-learning [7][18]. It provides various kinds of web services: for creating a user interface and offering personalization functionality. Core component of PRF is the connector service whose task is to pass requests and

answers between the user interface component and the personalization services. It also supplies and provides user profile information and providing metadata descriptions on learning objects [5].

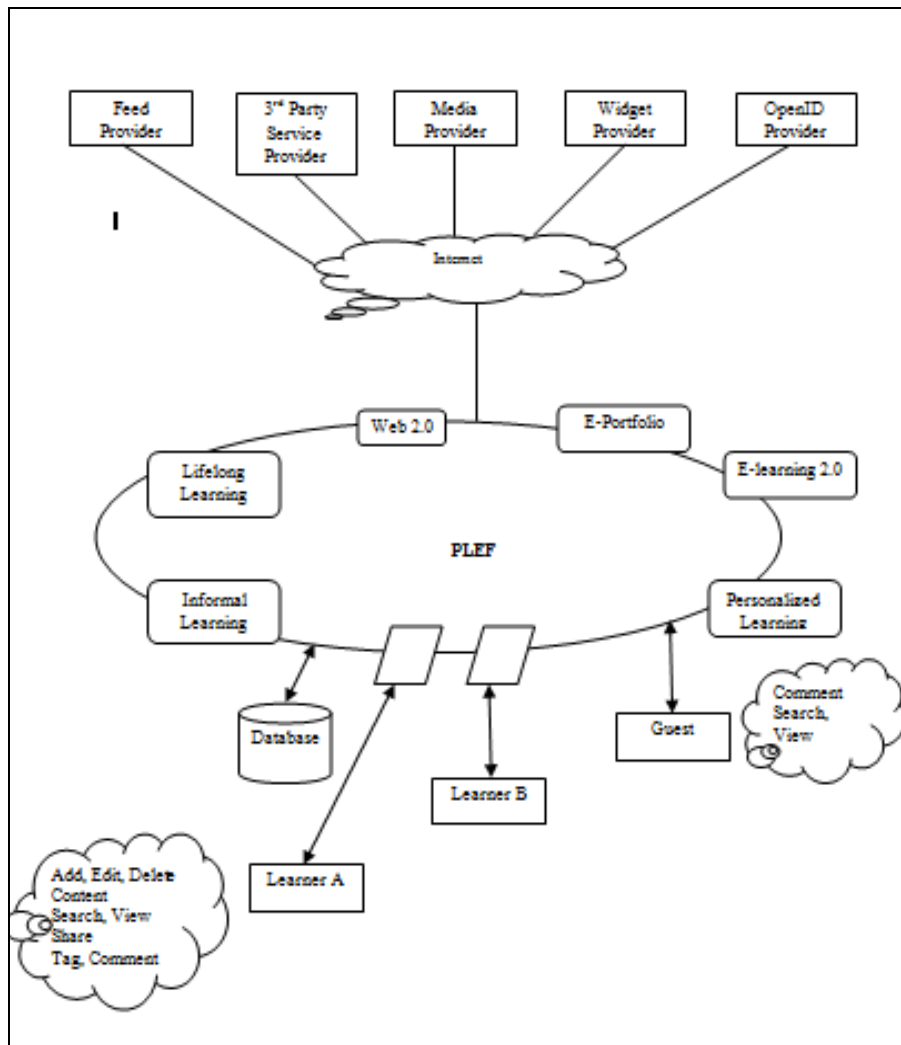


Figure 4: Architecture of PLE [20]

There are two approaches for personalized e-learning namely automatic approach and collaborative approach. An automated approach is based on the actual behavior of the learner towards a system during online learning progresses. In automated approach, the learner's adaptable models are built automatically. Intelligence and machine learning techniques exploit learner's interactions and behaviors while learners using the system. A collaborative style of teaching has changed from traditional teacher-centered teaching to a student or learner-centered learning in the classroom. According to [7], collaborative learning deals with other individuals in the process of learning. Learners have to respect other individual's abilities, skills and contributions in the group. There is a sharing of authority and acceptance of responsibility among learners for the other learner's action.

Classical e-learning systems are less adaptive and do not change according to student's interactions and preferences. To overcome this personalization problem a new method of recommendation based on user's similarity calculation is proposed in [5].

Authors in [5][13] developed an enhanced personal learning environment using semantic web technologies. It is based on a new method of recommendation which uses user's similarity calculation according to learner's interactions among themselves and within the system.

Authors in [8] proposed a smart learning environment based on semantic web. It personalizes learning environment and provides learners with suitable learning objects, learning activities, and teaching method based on their preferences and needs.

To make learning environment much more effective, the framework which exists for personalizing learning process is based on relevant Learning Objects only. For the solution of these problems the author proposed ontology concept [10].

Authors in [9] proposed an ontology based system which is deployed on DigitalOcean's remote cloud host. DigitalOcean is an easy-to-use and fast cloud hosting service built for

developers. All the required resources are also stored in the cloud. Agents are used to provide personalization based on Felder-Solomon questionnaire [9] [16].

3. Comparison of different e-learning systems

Table 1 shows the comparison of different parameters for traditional learning and personalized learning. The parameters include learning approach [5], selection of method [5], learning style [13], customization method, flow of knowledge to name a few.

Table 1 Comparison between Learning Management System and Personalized Learning Environment

Parameters	LMS	PLE
Learning Approach	Content-centric (One-size-fits-all)	Learner-centric (Personal and Responsive)
Selection of Method	Pre-defined selection of methods for learning like Learning objects, quizzes, etc.	Learner’s needs first, selection of method for learning second: According to user’s interests and preferences, the system find the best learning resources and users that better fit their needs
Approach	Formal learning support	Informal learning support
Learning Style	One-to-many	One-to-one or many-to-one
Learning Process	Designed for average learner	Customize as per characteristics of individual learner
Learning Material	Determined by educator	Determined as per learner’s requirements
Flow of Knowledge	Top-down: A clear distinction between the capabilities of learners and teachers, resulting into a one-way flow of knowledge.	Bottom-up: PLE provides bottom-up solution, driven by the learner needs and based on sharing among learners and teachers.
Knowledge Sharing	Command-and-control, one way of knowledge, Asymmetric relationships: Only teachers guide the learning process because they are the only person who disseminate knowledge	Symmetrical relationships: Both teachers and learners can create knowledge and share it
Interaction Mode	Static	Interactive
Construction	Structured	Agile
Flexibility	Rigid	Flexible
Knowledge Dissemination	Knowledge Push	Knowledge Pull
Content Up gradation	Solitary	Collaborative

4. Conclusion

E-learning is the major research area due to learner’s changing needs. Current e-learning systems use LMS a content-centric approach in which each user gets the same contents. But there is a need to develop learner-centric personalized learning to fulfill individual learner’s needs and preferences. Personal learning environment describes the tools, communities, and services that constitute the individual educational platforms which learners use to direct their own learning and pursue educational goals. PLE offers a portal through which learners can explore and create, according to their own interests and directions, interacting with their friends

and learning community of their choice. The literature study in this paper shows the learning management system and its issues which are resolved by the personal learning environment. Therefore, PLE supports the learners with knowledge dissemination at par with the rapid pace of knowledge change. PLE is an informal approach that allows a learner to communicate in a distributed environment consisting of a network of people, services and resources. As a result, focus on personalized learning to improve the e-learning and to satisfy the learner’s varying needs is of utmost importance.

References

1. P. Bhisikar and A. Sahu, “Overview on Web Mining and Different Techniques for Web Personalization” International Journal of Engineering Research and Applications”, pp. 543-545, Apr. 2013
2. R. Kosala and H.Blockeel, “Web Mining Research : A Survey”, ACM SIGKDD Explorations”, pp. 1-15, Jun. 2000.
3. J. Yadav and B. Mallick, “Web Mining : Characteristics and Application in E-Commerce” International Journal of Electronics and Computer Science Engineerings”, pp. 2020-2015, Jul. 2015.
4. K. Halimi, H. Seridi-Bouchelaghem, and C. Faron-Zucker, “An enhanced personal learning environment using social semantic web technologies”, Interactive learning Environment, pp. 165-187, Jul.2014
5. Paper Download
6. J. Yadav and B. Mallick, “Web Mining: Characteristics and Application in E-Commerce” International Journal of Electronics and Computer Science Engineerings”, pp. 2020-2015, Jul. 2015.

7. S. Ouf, M. Ellatif, and Y. Helmy, "A proposed paradigm for smart learning environment based on semantic web", Elsevier, pp.796-818, Sept.2016.
8. M. Rani, R. Nayak, and O. Vyas, "An ontology-based adaptive personalized e-learning system, assisted by software agents on cloud storage", Elsevier, pp.33-48, Oct.2015.
9. R. Peredo, A. Canales, A. Menchaca and I. Peredo, "Intelligent web-based education system for adaptive learning", Expert Systems with Applications, Elsevier, pp.14690-14702, 2011.
10. S. Vijayarani and E. Suganya, "Research Issues in Web Mining" International Journal of Computer-Aided Technologies", pp. 55-64, Jul. 2015.
11. M. Chakurkar and D. Adiga, "A Web Mining Approach for Personalized E-learning System", International Journal of Advance Computer Science and Applications, 2014.
12. Torniai, C., Jovanovic, J., Gasevic, D., Bateman, S., Hatala, M.: E-Learning Meets the Social Semantic Web. In: 8th IEEE International Conference on Advanced Learning Technologies (ICALT 2008), July 1-5, pp. 389–393 (2008).
13. M. Gaeta, S. Miranda, F. Orciuoli and S. Paolozzi, Antonella Poce3, "An Approach to Personalized E-learning", Systemics, Cybernetics and Informatics, 2013.
14. S.Yasodha, and S. Dhenakaran, "An Ontology-Based Framework for Semantic Web Content Mining", in International Conference on Computer Communication and Informatics (ICCCI -2014), 2014.
15. Jain, S., Jain, D., Bhojak, H., Bhilwar, A. and J. M. (2012). Personalization of e-Learning Services using Web Mining and Semantic Web. International Journal of Machine Learning and Computing, pp.569-572.
16. De Bra, P., Kay, J., Weibelzahl, S. (eds.): Special Issue on Personalization. IEEE Transactions on Learning Technologies 2 (2009)
17. Francisco J. García-Peñalvo, Miguel Á. Conde, Marc Alier, and María J. Casany, , Opening Learning Management System to personal Learning Environments, Journal of Universal Computer Science, pp.1222-1240, 2011
18. <http://theelearningcoach.com/elearning2-0/designing-personal-learning-environment/>
19. http://etec.ctlt.ubc.ca/510wiki/Personal_Learning_Environments_%28PLE%29