A Framework for Enabling Incidental Learning on the Web

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Abstract

Incidental learning is learning something without intent, which usually happens at the time that is not dedicated to learn that thing. Examples of such time include work, game play and activities for leisure. In today's life of many people, a lot of time is spent on the surfing the Web. Should incidental learning be effectively implemented for individuals using the Web, it would make learning more effective for many. This can be especially true for adult learners since they most likely have less time dedicated to learning, or don't have any dedicated time for learning at all. In this paper we present a framework for enabling incidental learning on the Web. The framework identify six key elements for incidental learning on the web, describe a general process of incidental learning, two types of incidental learning and nine scenarios of incidental learning on the web. Finally, the framework prescribes a list of theories and essential technologies that are important for enabling incidental learning on the web.

Keywords: *incidental learning, informal learning, web-based learning, e-learning*

Introduction

Incidental learning is learning without intent, which happens at the time that is not dedicated to learn what is learned through the incidental learning session [1]. In today's society, we are given at least two advantages in developing and implementing enabling technologies and systems for incidental learning on the Web. The first one is that many individuals are spending a lot of time on the Web. This would make incidental learning on the web be able to occur more often. Imagine that such an "incident" could occur only once a year or even only once a lifetime, it might be enough to trigger a scientific invention for a well-prepared scientist, but wouldn't be enough for someone to learn substantially on a subject. As such, it makes more sense now for us to develop enabling technologies and systems for incidental learning on the web because more and more people will benefit from the technologies and systems more often. The second advantage we are given is the unprecedented availability on the world-wide web of knowledge of almost all subjects. This greatly ensures the feasibility of the research and development of technologies and systems in terms of source of knowledge and information. Because the information and knowledge needed to feed the learners on the Web is widely available, a software or intelligent agent should be able to collect the particular knowledge and information especially for an individual based on his/her overall learning goals and feed the individual in a way without his or her notice.   As such, the enabling technologies and systems developed from this research could be used to learn knowledge in various topics and subjects!

In brief, the theories, technologies and systems developed from this research are intended to make incidental learning happen to learners while they are browsing the web; to make incidental learning on the

web serve at least one of the learning goals the learners may have at the time; and to make incidental learning on the web more effective.

Significance and Contributions of the Research

Incidental learning brings at least two benefits to learners. One is that it effectively utilizes the times or tiny fractions of time that are not designated for learning; the second is that people will be able to learn with a pleasure but without pressure. They would be much happier to learn with less or no stress. Imagining that you could learn something effectively for a purpose or purposes while you are browsing the Web for pleasure, and imagining that people, such as our students, could build their knowledge and skills to satisfy the requirements of a course or courses while you are working or playing with the Web, isn't it wonderful and very significant in education and research?

The benefits can be more obvious for students taking online courses or other distance learning courses. As we know, most of these students are part-time as they often have other business to do other than completing courses. They cannot afford to take leave to study in traditional universities in the classroom, and they don't usually have a big trunk of their time to spend on a course study. However, they do spend time on the web for various reasons and purposes. If enabling technologies and systems are available for incidental learning on the web, it will help these learners greatly, because these students will be able to utilize fractions of their time to learn while they are working, playing or doing other things. The framework presented in this paper is intended to set a firm step towards the enabling technologies and systems.

Key elements of incidental learning

For a system that helps learners to realize incidental learning on the web, some key elements are needed:

1. Learner's capability of learning – this is the very basic requirement for incidental learning, or any learning to occur. An agent system designed for enabling incidental learning on the web must do its best to know what the learner is capable of learning. A learner may be capable of learning X but not Y. it won't help the learner to keep firing up incidental learning sessions that teach the learner something he or she is incapable of.
2. Learner's desire to learn -- without any desire to learn, no learning can be effective. The desire can be fostered gradually through certain enabling technologies. This may be the hardest part for an agent to do – to know whether the learner has the desire to learn at a specific time. The information may be gathered during the time learner is browsing the web, or after two or three tries of firing up an incidental learning session – when the learner has simply ignored. In any case, it is important for the agent system to know if the learner has the desire to learn at a given time; otherwise it would definitely be an annoying thing to the learner to keep firing up one incidental learning session after another.
3. Learning goals of the leaner – what topics and subjects the learner is interested in, at what level the learner is in a particular area or topic.
4. Triggers to fire up an incidental learning session – the system needs to be fired up at the right time while the learner is on the web. The triggers should be within the web document the learner is reading, together with the learner's motion such as mouse click.

5. Available learning content – the system must be able to get the right learning content to form a learning session for the learner. The content can be in a learning object repository, or mined from the web on the fly.
6. An effective incidental learning session – the session must be well controlled and properly sized in terms of both content and duration.

These key elements must be fully considered in the design and development of enabling technologies and systems for incidental learning on the web.

General process of incidental learning on the web

Incidental learning may happen consciously or unconsciously. In the former case, the learning session happens incidentally while the learning is doing something else, but during the session, the learner consciously knows she or he is in the learning session, and knows what he is supposed to learn. With consciousness, the learner could be more motivated during the session, and the learning should be more effective.

In the latter case, not only does the learning session, if it can be called a learning session, occur incidentally, the learner doesn't even know he or she is in a learning session, and what she or he is learning either.

For some learners, learning with a clear purpose or consciously should be more effective, while for learners who are really tired of learning certain things in certain area, incidental learning unconsciously should be more effective too.

While the learners may learn consciously or unconsciously, the agent system enabling incidental learning on the web must know what a particular learner is supposed to learn in a specific learning session. Hence, the process of incidental learning on the web can be generally depicted as follows:

1. Identify the point of interest within the context of what the learner is doing, or browsing in the case of web-based incidental learning;
2. Further develop the point of interest into a specific learning objective or objectives which are part of the learner's learning goals at the time;
3. Form a small learning session with content dynamically generated from the web or learning object repositories, and bring the learner into the learning session;
4. Present the learning session to the learner and/or bring the learner into the learning session;
5. Closing the session once the learner is done, or has left the session, and book keeping the learning session.

**Types of Incidental Learning and Scenarios on the Web**

The unique feature of incidental learning is that learning occurred incidentally in the view of the learner. Although the occurrence of learning may seem to be random (that's why incidental learning is also called random learning), the knowledge and skills acquired through it don't need to be random, especially when

the incidental learning session is enabled by an intelligent agent system. That is to say, the learning outcome can be either expected or unexpected by the learner. We then have the following two types of incidental learning:

1. incidental learning from which something expected has been learned, we use letter E to refer to such learning, use letter E with a subscript to refer a learning goal that may consists of small gradients of learning goals or knowledge, denoted by letter e with or with a subscript.
2. incidental learning from which something unexpected has been learned, we use letter U to refer to such learning, use letter U with a subscript to refer a learning goal that may consists of small gradients of learning goals or knowledge, denoted by letter u with or with a subscript.

Let $E=\{E_1, E_2, \ldots, E_m\}$ represent the learning goals identified for a particular learner at a given time, and each $E_i=\{e_{i1}, e_{i2}, \ldots, e_{ik}\}$, where each e_{ij} represents a small learning goal or knowledge gradient; we further let $U=\{U_1, U_2, \ldots, U_m\}$ represent the learning goals identified for a particular learner at a given time, and each $U_i=\{u_{i1}, u_{i2}, \ldots, u_{ik}\}$, where each u_{ij} represents a small learning goal or knowledge gradient, we then may have the following different scenarios of incidental learning on the web:

1. incidental learning towards a consistent learning goal expected for the learner
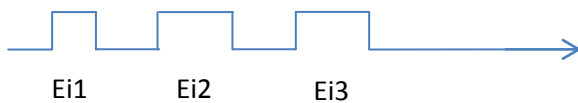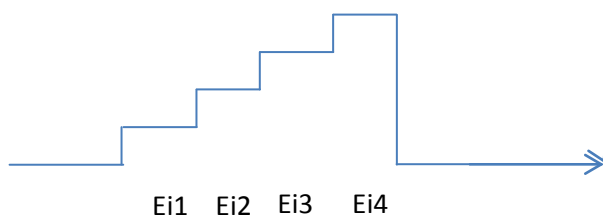

Ei1   Ei2   Ei3

In this scenario, the learner is going through several incidental-learning sessions fed by the agent, and all the knowledge gradients covered by the incidental learning sessions serve the same learning goal. After each incidental learning session, the learner will go back to his or her non-learning web browsing;

2. Incidental learning spread several learning goals, but all expected for the learner
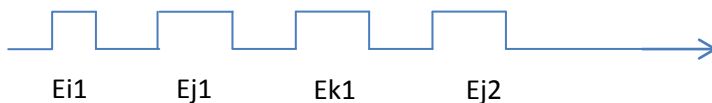
Ei1   Ej1   Ek1   Ej2

In this scenario, the learner is going through several incidental-learning sessions fed by the agent, but the knowledge gradients covered by the incidental learning sessions serve the several different learning goals. After each incidental learning session, the learner will go back to his or her non-learning web browsing;
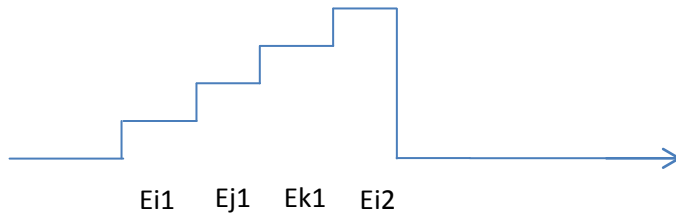
3. One incidental learning after another serves the same learning goal

Ei1   Ei2   Ei3   Ei4

In this scenario, the learner is going through one incidental-learning session after another fed by the agent, and all the knowledge gradients covered by the incidental learning sessions serve the same learning goal.

After going through several incidental learning sessions, the learner then goes back to his or her non-learning web browsing;

4. One incidental learning after another serves different learning goals

Ei1   Ej1   Ek1   Ei2

In this scenario, the learner is going through one incidental-learning session after another fed by the agent, but the knowledge gradients covered by the incidental learning sessions serve different learning goals. After going through several incidental learning sessions, the learner then goes back to his or her non-learning web browsing;

5. incidental learning towards a consistent learning goal unexpected for the learner
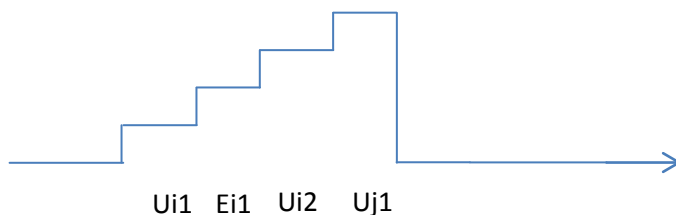
Ui1   Ui2   Ui3

In this scenario, the learner is going through several incidental-learning sessions fed by the agent, and all the knowledge gradients covered by the incidental learning sessions serve the same learning goal. After each incidental learning session, the learner will go back to his or her non-learning web browsing;

6. Incidental learning spread several learning goals, but all unexpected for the learner

Ui1   Uj1   Uk1   Uj2

In this scenario, the learner is going through several incidental-learning sessions fed by the agent, but the knowledge gradients covered by the incidental learning sessions serve the several different learning goals. After each incidental learning session, the learner will go back to his or her non-learning web browsing;
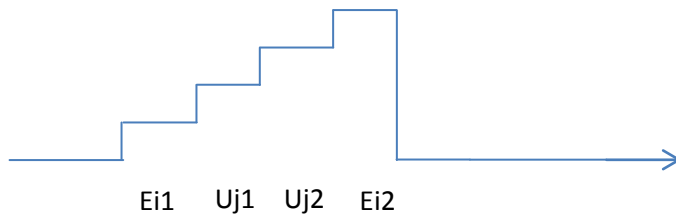
7. One incidental learning after another serves for a mix of expected and unexpected learning goals

Ui1 Ei1 Ui2   Uj1

In this scenario, the learner is going through one incidental-learning session after another fed by the agent, and knowledge gradients covered by the incidental learning sessions serve a mix of different learning
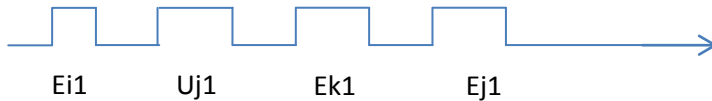
expected or unexpected goals. After going through several incidental learning sessions, the learner then goes back to his or her non-learning web browsing;

8. One incidental learning after another but serves one expected learning goals and one unexpected learning goal

Ei1   Uj1 Uj2 Ei2

In this scenario, the learner is going through one incidental-learning session after another fed by the agent, and the knowledge gradients covered by the incidental learning sessions consistently serve one expected learning goal and one unexpected learning goal. After going through several incidental learning sessions, the learner then goes back to his or her non-learning web browsing;

9. Incidental learning spread several expected and unexpected learning goals

Ei1   Uj1   Ek1   Ej1

In this scenario, the learner is going through several incidental-learning sessions fed by the agent, and the knowledge gradients covered by the incidental learning sessions serve several different expected and unexpected learning goals. After each incidental learning session, the learner will go back to his or her non-learning web browsing.

The nine scenarios discussed above is not an exhausted list of all possible scenarios. In real cases without control, some learners may jump from one 'incidental learning session' from another across many different topics and subjects, while some may more likely stay with one topic or one subject. What this research is intended to do, however, is to implement a software agent which is able to assist learners and make incidental learning on the web for better results, and to better serve the learning goals of the learner.

Theories and enabling technologies important for the success of incident learning on the Web

To successfully design and implement an intelligent agent system to assist learners by making incidental learning on the web not only happening, but also controlled for better purposes and effects, the following theoretical and technical areas are very important:

1. Learner modeling for their personality and learning style. This is important for the intelligent agent in order to form and render right incidental learning sessions to the learner, to ensure the learning sessions are not only accepted but also welcome by the learner;

2. Learning and building learning goals for the learner. The main purpose of intelligent agent system is to not only make incidental learning on the web happen, but also happen to serve the learner's learning goals. Therefore, knowing what the learning goals are is very important.
3. Data/web mining to build incidental learning session dynamically. The system should be able to discover and select the best fit learning objects or material to form an incidental learning session whenever a trigger for a learning session is identified for the learner. Therefore, it is important for the agent system to do data mining on the web.
4. Doing effective learning analytics for adjust and fine-tune the learner models for better incidental learning sessions. Each incidental learning session should be evaluated after it's over, and the learner actions and performance during the sessions should be analyzed.
5. Intelligent agent technologies. While the proposed framework and the theories and technologies listed above are important for developing an intelligent agent for enabling incidental learning on the web, agent theories and technologies developed over the last few decades by researchers and practitioners in computing and AI community in particular are definitely a great asset for the success.

The above may not have covered all the important theories and technologies for designing and developing an intelligent agent for enabling incidental learning on the Web, but they do form a core or base for anyone to do further research and development in this direction.

Discussions

We presented in this paper a framework for enabling incidental learning on the Web. In the framework we have identified some key elements for enabling incidental learning on the web. These key elements are important for the design and implementation of any agent system for enabling incidental learning on the web.

We further discussed the general process of incidental learning on the web, two types of incidental learning, as well as several scenarios of web-based incidental learning. These are all parts of the entire framework on which intelligent system can be built to enable web-based incidental learning.

References

1. Baskett, H. K. M., Workplace Factors Which Enhance Self-directed Learning, a report of a project on self-directed learning in the workplace, a paper presented to the Seventh International Symposium on Self-Directed Learning, West Palm Beach, Florida, January 21-23, 1993. Available online at http://www.eric.ed.gov/PDFS/ED359354.pdf
2. Baylor, A.L. Perceived disorientation and incidental learning in a Web-based environment: Internal and external factors J of Educational Multimedia and Hypermedia Vol. 10/3 227-251:2001
3. Elley, W.B. (Dez 2005), [http//cela.albany.edu/reports/inpraise/main.html In praise of incidental learning: Lessons from some empirical findings on lan guage acquisition: 1997]
4. Kerka, Sandra 2000, Trends and Issues 2000 Alert No.18, Incidental learning
5. Marsick, V.J. & KJ Watkins (2001). Informal and incidental learning, new directions for adult and continuing education 89 25-34.
6. Mayer, R.E., Heiser, J. & Lonn,S. (2001). Cognitive constraints on multimedia learning: when presenting more material results in less understanding. Journal of educational psychology, 93 pp.187-198
7. Schank, Roger, C. & Ch. Cleary (1995). Engines for Education, Lawrence Erlbaum Ass. Publishers Hillsdale NJ, pp. 95-105 (Incidental learning chapter).