CHAPTER 3
LEARNER PROFILE ONTOLOGY CREATION
AND CONCEPT MAP GENERATION FOR
ADAPTIVE E-LEARNING

3.1 INTRODUCTION

In this chapter, a new adaptive ontology based E-learning model is introduced to provide adaptive teaching content to the learners based on their knowledge level. The adaptive teaching and learning using ontology generates the concept map to update the instructor about the current knowledge level of the learners. The proposed technique involves the process of creating learner profile, distribution of study materials and online examination, text pre-processing, text matching and dimensionality reduction, adaptive teaching contents are provided to the learners on assessment of their knowledge level by comparing the similarity between preprocessed test document and original teaching content through Fuzzy and Neuro Fuzzy techniques, concept extraction and concept map generation.

The suitable study material has to be provided based on the knowledge level of the learners through the concept map generation process, as the knowledge level varies for every learner. The generated concept map contains information about user preference on topics and current knowledge level on the particular topic. The adaptive E-learning technique using concept map provides a learning path to the learner with least interaction with the instructors. Moreover, the instructor also should be able to know the current knowledge level of the learner through automatic concept map generation. Thus the requirement of providing adaptive teaching content to the learners is achieved to a better possible way by this proposed adaptive E-learning
framework that models a separate concept generation module to enclose the functions within a system.

3.2 ONTOLOGY

The World Wide Web is an ever-zooming treasure house of fruitful data intended for the beneficial use of the inhabitants of the Marble Blue which we fondly call the “Planet Earth”. Striking an entirely discordant chord, the Semantic Web vision, is dedicated in the direction of an automatic computer-based processing of data on the Web, thus inviting a sea change to the overall scenario.

Further particularly, for the purpose of effectively exploiting the data on the Web, it is highly essential to interpret the titanic compilation of accessible data in the backdrop of knowledge. Thus the information on the web has to be complemented with the semantic data. This is best realized by explicitly furnishing the meaning of documents on the Web and in this perspectives; the ontologies have a very vital part to play. The ontologies facilitate an illustration of data which enables inference to be carried out, thereby achieving novel insights. Characterizing the knowledge in the shape of a conceptualization such as the ontologies is highly critical for the automatic processing of the data on the Web. Nevertheless, the ontologies are endowed with the requisite skills of improving the management, distribution and retrieval of the learning material within a Learning Management System (LMS) and hence capable of playing a very significant part in the domain of the E-learning by Monachesi et al. (2008) static and dynamic content by utilizing the Language Technology resources and devices for the semi-automatic generation of descriptive metadata while the semantic data is incorporated to fine-tune the management, distribution and the search of the learning material by Alkhuraiji et al. (2011).
The teachers and the resources management personnel have to exhibit their group initiative to generate the teaching resources willingly as a team for the creation of further efficient learning platforms for the benefit of the learners by Quanyu Wang et al. (2012). The E-learning environment dependent on ontology integrates the educational resources, people and educational scenario into a shared knowledge base in accordance with the semantics technology by Maha Al-Yahya et al. (2015). The corresponding knowledge base offers the general comprehension of the knowledge in the E-learning environment, decides the words generally acknowledged in the environmental system of E-learning in addition to the clear-cut definition of the interrelationship between word and word. The learners are capable of generating the learning environment by themselves to participate in the autonomous learning activities in an active and proactive way.

3.3 ARCHITECTURE OF ADAPTIVE ONTOLOGY BASED E-LEARNING SYSTEM USING CONCEPT MAPS

With an eye on fine-tuning the E-learning procedure, the adaptive E-learning is advocated which squarely dispenses with the requisites of an instructor and facilitates the instructor to know the current knowledge level of users whenever they wish to learn. The innovative ontology based adaptive E-learning system with concept map fantastically flows through the following seven phases: creating learner profile, distribution of study materials and online examining, text pre-processing, text matching and dimensionality reduction, comparing the similarity between preprocessed test document and original teaching content through fuzzy and neuro fuzzy techniques, concept extraction and concept map generation.
The Figure 3.1 shows the system architecture of adaptive E-learning using concept map generation. In the initial stage, a learner profile ontology is created with user details and subject’s topic preferences and suitable teaching contents are provided based on the learner profile ontology. At second stage, Online examinations will be conducted based on the study materials to test the learner’s ability. The answers obtaining in the form of text document is then proceeded with text pre-processing. Here in the third phase, the tasks such as the Document Parsing, eradication of stop words, Stemming and Parts of Speech tagging and linguistic pattern filtering will be performed.

At the fourth stage, text matching is done with the help of word net to obtain the matrix value between the original text document and the preprocessed test document. Dimensionality reduction of the text matched matrix will be elegantly executed with Singular Value Decomposition (SVD) algorithm to reduce the size of the matrix.
The fifth stage involves the adaptive teaching contents are provided to the learners on assessment of their knowledge level by comparing the similarity between preprocessed test document and original teaching content through fuzzy and neuro fuzzy techniques, which is employed here to find the score value of the test document. It is utilized to provide the further contents. Retesting will be performed on weak subjects based on the score values. In the long run, the study materials are supplemented based on the skills level of the learner so as to enable them fine-tune their present skills levels. In the concept extraction phase, the contents learned by the learner could be extracted. The extracted concepts are utilized to generate a concept map in the final stage for the instructor to know the current knowledge level about the learner and help to provide teaching contents adaptively to the next level.

3.4 OBJECTIVES OF ADAPTIVE E-LEARNING SYSTEM WITH CONCEPT MAPS

In this work, the novel approach effectively employs the ontology based adaptive E-learning to successfully tackle the constraints of the existing E-learning techniques. The fundamental motive of the current investigation is devoted to the design of an appropriate architecture for the adaptive system. The vital motives of the current investigation are detailed as follows.

- The introduction of new innovative adaptive E-learning framework with the use of the ontology.
- The production of an acceptable and pedagogically appropriate learning path
- The precise adaptation of the learning contents to the learners in accordance with their skills
- The proposal of adaptive guidance for the learners at runtime in accordance with their interface with the system
3.5 ADAPTIVE ONTOLOGY BASED E-LEARNING SYSTEM ALGORITHM

E-Learning uses the information and communication technologies to enhance teaching and learning process. Now learners are overloaded with E-learning resources and they are finding it difficult to choose the best material for the specific topic. Since the maturity of the Internet technologies and the decreasing cost of the hardware platforms, more educational institutions are using E-learning as an effective method for effective teaching learning process. The main objective of this algorithm is to facilitate adaptive teaching learning using ontology, here the instructors can dynamically revise and deliver instructional materials according to the learners’ current progress.

In the algorithm shown in Figure 3.2, the overall processes take place in the proposed adaptive learning scheme, where the step 1 showing the process of creating learner profile with preferred topics and user details (name, occupation, etc.,). The main aspect of this adaptive teaching and learning system is to generate concept maps. In order to generate the concept maps the created learner profiles with different user’s thought about giving preference to topics were gathered initially to generate a Learner Profile Ontology (LPO). In step 2, the generated ontology is used to provide the study materials based on the users knowledge level (i.e., learner preference to certain topics).

Thus, the related study material has been given based on the learner preference and online examination will be conducted, so that, the learner could be able to acquire knowledge on the preferred topic. With those answers obtained in the form of text documents, preprocessing is to be performed in the step 3. In text preprocessing, initially the document is parsed, removed with stop words, performed with Stemming and Parts of Speech tagging and finally specific linguistic patterns were filtered.
ADAPTIVE ONTOLOGY BASED E-LEARNING ALGORITHM

Step 1: Create Learner Profile
- Learners Register with preferred topics and user details
- Develop Learner Profile Ontology (LPO)

Step 2: Online Examining
Provide Related contents and make tests on that contents

Step 3: Text Pre-Processing
Performing Text Pre-Processing for the obtained answers in the form of text documents. The steps are
- Document parsing
- Stop word removal
- POS tagging
- Stemming
- Filter specific linguistic patterns.

Step 4: Text Matching and Dimensionality Reduction
- Text Matching is made with word net for the pre-processed text document and original test document.
- Singular Value Decomposition (SVD) to reduce the dimensionality of the text matched matrix.

Step 5: Fuzzy / Neuro Fuzzy Logic
- Employing Fuzzy / Neuro Fuzzy Logic to the text matched matrix
- Getting Score values
  (i) Content Sharing:
  - Set Threshold
  - Get Contents
    - For score value outcome less than particular thresholds otherwise
  - Re-Examining
(ii) Knowledge Updating:
  Update knowledge of learners with shared contents

Repeat
Step 2 to 5

Until Learner is fully Updated

Step 6: Concept Extraction
Extract the concepts on which the learner is fully skilled.

Step 7: Concept Map Generation
The extracted concepts were drawn in the form of a concept map for the ease of instructor to view the current status of learner.

Figure 3.2 Adaptive Ontology based E-learning algorithm
Then with the preprocessed documents, the process of text matching is made with word net for the obtained answers in the form of text documents and the original test documents. After the text matching, the dimensionality is reduced by means of employing Singular Value Decomposition algorithm in step 4 of the algorithm.

The similarity between preprocessed test document and original teaching content through Fuzzy and Neuro Fuzzy techniques, where the resultant obtained will be in the form of score values in step 5. Based on those score values, the provided contents will be redistributed and re-examined or proceed with further contents. The redistribution of study materials and re-examination will happen in case of attaining lower score values than the predefined threshold. The process of online examination and reexamination is to be continued until the user acquiring complete knowledge about all the preferred topics in the particular domain in order to update their knowledge level.

In step 6, the skilled areas will be extracted for every learner based on the online exams written. Through the online test results, the instructor could also understand about the user’s ability. Moreover, for any user who is entering the adaptive teaching and learning system module, a concept map will be generated to facilitate the current knowledge status of the learner in step 7.

3.6 IMPLEMENTATION OF ADAPTIVE E-LEARNING FRAMEWORK

This Framework provides automatic analysis of learners’ progress in terms of the knowledge structures they have acquired. This section illustrates a novel methodology of automatically constructing concept maps using ontology to characterize learners understanding for a particular topic,
thereby instructors can conduct adaptive teaching and learning based on the learners knowledge structures as reflected in the concept maps. This novel approach enhances existing fuzzy domain ontology extraction algorithm by using Neuro Fuzzy technique to find the similarity between original teaching content with online test content. This framework helps the tutor to use adaptive teaching and for learners to improve their learning process by constructing concept maps automatically. The proposed framework involves the following phases,

- Learner Profile Creation and Learner Profile Ontology Generation
- Study Material Distribution & Online Examination
- Text Pre-Processing
- Text Matching and Dimensionality Reduction
- Knowledge Level updation using Fuzzy / Neuro-Fuzzy
- Concept extraction
- Concept Map Generation

3.6.1 Learner Profile Ontology Creation

Initially, for every user entering the adaptive technique, a learner profile is to be created. The learner profile contains the personal information of the user, the knowledge level of the user and their preferences about the topics in some particular domain. In our technique, the learner is first made to select a domain of interest so that the relevant topics will be displayed at the adaptive teaching and E-learning page. This enables the user to get ideas about their required areas. The user will be then made to enter some topics.
Based on the users’ preference about the concepts, the profile will be created. Moreover, the learner profile includes the user name, password, user occupation along with the topic preferences. The password and usernames are provided based on the users. In case of existing user names, they were asked to provide a newer name. Likewise, the learner profile will be created for a number of users. The created learner profiles with the varying user preference will be utilized to generate the learner profile ontology. The ontology is generated with the help of an ontology learning Environmental tool, particularly the Ontology Word Language (OWL) tool. The generated ontology is then stored at the Local Instance Repository (LIR).

3.6.2 Study Material Distribution and Online Examination

The generated Learner Profile Ontology (LPO) contains the learners preferred topics. With that learner preference, study materials were distributed. Online examinations will be conducted based on the study materials to test the learner’s ability. The answers obtaining in the form of text document is then preceded with text pre-processing.

3.6.3 Text Pre-Processing

The user preferences were generated for a number of users and for determining each user’s ability. Online exams will be made on their preferred topics and the obtained text documents are then preprocessed. The procedure of the text pre-processing plays a vital part in the domain of the text mining. With an eye on scaling down the dimensionally of the document words, special techniques like the filtering and stemming are performed. The filtering approaches elegantly discharge the function of eradicating the words which fail to furnish pertinent data, from the set of the complete words. The pre-processing text is known as the tokenization or text normalization. The pre-
processing procedure may be broadly categorized into five text functions or transformations such as the document parsing, elimination of Stop words, Stemming, POS Tagging, and then finally Linguistic Pattern filtering.

3.6.3.1 Document parsing

The particular document parser is utilized to handle the particular report construction and get the particular report information based on a set of guidelines chosen with the administrator of the search engine in which the parser is actually running. Most of these guidelines are generally known as attribute definitions, which can be made with the parser. The particular document parsing point is essential, since it is the linguistic features supplying by far the most hints for that attribution.

3.6.3.2 Elimination of stop words

The input furnished document is assessed and analyzed by the elimination of the stop words. Thereafter, the residual contents are so orchestrated as to facilitate its continuity and lucidity. In this regard, the Text Pre-processing is the initial component here, which is well-geared to efficiently eradicate the stop words from the documents. As a matter of fact, a word which emerges in 80% of the documents in the compilation is virtually worthless and are habitually labeled as the stop words. Words such as articles, prepositions, and the conjunctions are eliminated as they possess no type of informatics. Moreover, the removal of the stop words brings with it a supplementary significant advantage of drastic cutback in the dimension of the indexing structure.
3.6.3.3 Stemming and POS tagging

The next-in-line in the Text Pre-processing is the procedure of stemming and POS tagging of the source document. The stemming of keywords, in essence, includes the extraction of the root words like the plurals and gerunds. A stem, in turn, represents the segment of a word which is left after the elimination of its affixes such as the prefixes and suffixes. In fact, the stemming also exerts an immense influence in the reduction of the dimension. The removal of such words can be achieved by means of utilizing the WordNet. Additionally, the document is checked once again that it should not contain words with similar meaning (i.e. distinct words are selected).

3.6.3.4 Linguistic pattern filtering

The aim of linguistic preprocessing is to annotate any file with pertinent lexico syntactic details. Linguistic knowledge can be employed for textual evaluation systems as a way to determine specific patterns of information by using through textual clues, that identification employs generally lexical files and also text composition as it is of user dependent. The Lexical analysis represents the task of transforming a stream of characters into a stream of words. Moreover, one of the vital motives of the lexical analysis phase is the detection of the words in the text. For example, the four specific cases to be taken into account with diligence include the digits, hyphens, punctuation marks, and the case of the letters. Usually, the punctuation marks are eliminated entirely in the task of the lexical analysis. Moreover, the lexical analyser habitually transforms the entire text to either lower or upper case.
3.6.4  **Text matching and dimensionality reduction**

The preprocessed text is matched with the original text document. Text matching is done with the help of Word Net, which is a lexical database for the English language. In text matching, the text documents will be matched with the help of Word Net and a matrix is generated. The text document involves the answers obtained through the online examinations performed in order to assess the knowledge level of every user. The text matched output will be in the form of a matrix. In order to reduce the size of the matrix, Singular Value Decomposition (SVD) method is employed.

In the pre-processing task, the input sets of documents are adapted into plain text documents (Windows ANSI). The adapted text has to be filtered from the entire control characters and discretization marks. With the intention of achieving a feature vector constituted by the most vital features, an innovative feature reduction technique viz. the Singular Value Decomposition is smartly launched. The innovative SVD approach represents a matrix decomposition method which elegantly carries out the function of the dimensionality cutback of a dataset.

3.6.4.1  **Singular value decomposition algorithm**

The SVD effectively discharges the function of mapping the original dataset to a lower dimensional space in such a manner that irrelevant features are discarded simultaneously conserving the features with wide variation (Jakub Wagner et al. 2015)

With an eye on choosing the optimum number of attributes, a variance value has to be appropriately defined, and all the attributes having the variance value which are lesser than the specified value are chosen. The eradication of the chosen components in the singular value decomposition of
the ensuing matrix, whose rows possess the data sequences achieved at the
time moments is furnished as, \(c_n, c_{n-1}, \ldots, c_{n-K+1}\);

\[
Y_n = \begin{bmatrix}
y_1(c_{n-K+1}) & \cdots & y_T(c_{n-K+1}) \\
\vdots & \ddots & \vdots \\
y_1(c_n) & \cdots & y_T(c_n)
\end{bmatrix}
\]

(3.1)

where, \(k\) represents a parameter. The SVD of the matrix \(Y_n|_{K \times T}\) in
Equation (3.1) illustrates its factorization as represented in Equation (3.2)
through Equation (3.4).

\[
Y = P \ast \sigma \ast Q
\]

(3.2)

where, 
\[
\sigma = [\text{diag}(\sigma_1, \ldots, \sigma_K)]_{K \times (T-K)}
\]

(3.3)

\[
P^T P = I & Q^T Q = I
\]

(3.4)

where, \(I\) represents the identity matrix, and \(\sigma_1 \geq \ldots \geq \sigma_K > 0\)
signifies the ostensible singular values of the matrix \(Y_n\). \(P\) and \(Q\) are orthogonal to each
other. Here, the least singular values are eliminated as it contains only less
useful data. Like this way, the dimension of data is reduced and then
forwarded to the Neuro Fuzzy logic.

3.6.5 Fuzzy/Neuro Fuzzy Logic to Measure Similarity between
Documents

The Fuzzy and Neuro Fuzzy techniques are used to measure
similarity between the documents. To improve the similarity performance the
Neuro Fuzzy logic is employed to generate the relationship between the text
documents. Matrix values generated from the content Database and the text
matched matrix outputs are given as input to the Neural Networks for the
process of training is done for those concepts (concept with correct answer
documents). Fuzzy logic is used to generate the rules based on the
membership functions. In the fuzzy logic systems, initially the fuzzification process is done at the network, where the crisp values are converted into linguistic values. Then based on the membership functions provided, the rules are generated. Finally the process of defuzzification will be done to retrieve the original data format (Xiang-Yong Cheng et al. 1994). Neural Network is an artificial intelligence technique used for generating the training data set and then for testing the applied input data sets. Neural Network consists of three layers such as the input, hidden and output layers. Neural Network will be of Feed Forward Neural Network or the Back Propagation Neural Network (Sadra Azizia et al. 2016).

Neuro Fuzzy systems represent a model of neural network model integrating the Fuzzy logic. Let the input number of concepts be \( c_n \), for which the training process is done. Initially, some weights will be added to the input neurons at the input layer randomly. Then for those inputs the weighted output is generated by multiplying the weights. The Bias Function (weighted outputs) obtained is a product of weights and inputs given in Equation (3.5).

\[
(c_{NN})_{out} = \alpha + \sum_{n=1}^{h} (c_n)w_n
\]

where,
- \( \alpha \) - Constant
- \( w_n \) - Weights added
- \( c_n \) - Input to the NN

Equation (3.6) is used as the activation function of the hidden and output layer

\[
H(n) = \frac{1}{1 + \exp \left( -c_{NN} \right)_{out}}
\]
Here, the sigmoid function is used as an activation function. Then the error value will be calculated as the difference between the known outputs and the weighted neural network outputs using Equation (3.7). The error achieved in the neural network is of,

$$NN_{error} = (c_{NN}^{target}) - (c_{NN}^{out})$$  \hspace{1cm} (3.7)

where,

- \((c_{NN}^{target})\) - Desired Output
- \((c_{NN}^{out})\) - Obtained output from the NN

The weights of all neurons are adjusted using Equation (3.8)

$$w = w + \delta w$$  \hspace{1cm} (3.8)

where \(\delta w\) is the change in weight and can be determined using Equation (3.9)

$$\delta w = \zeta c_{NN} \cdot NN_{error}$$  \hspace{1cm} (3.9)

where, \(\zeta\) is the learning rate, normally it varies from 0.2 to 0.5. The value of error should be less than 0.1, until that the process should be continued i.e. \(NN_{error} < 0.1\). Until that, the weights will be back propagated and updated with newer values. Based on the minimum error values, the appropriate weights are fixed at the hidden neurons. The weighted output from the BBN neuron is passed to the fuzzy logic. Then the fuzzy rules are generated for the best weighted output. The values are divided into following linguistic constructs LOW, AVERAGE, HIGH and EXTREME. Then, for the linguistic variables, fuzzy rules are generated as shown in Table 3.1.
Table 3.1 Generated fuzzy rules

<table>
<thead>
<tr>
<th>RULES</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>L ∩ L ∩ L ∩ L ∩ L ∩ L</td>
<td>LOW</td>
</tr>
<tr>
<td>L ∩ H ∩ H ∩ L ∩ H ∩ L</td>
<td>AVERAGE</td>
</tr>
<tr>
<td>L ∩ L ∩ H ∩ L ∩ H ∩ H</td>
<td>AVERAGE</td>
</tr>
<tr>
<td>L ∩ L ∩ H ∩ E ∩ H ∩ H</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

**Rule 1:** IF function1 is low AND function2 is low AND function3 is low AND function4 is low AND function5 is low AND function6 is low THEN result is LOW;

**Rule 2:** IF function1 is low AND function2 is high AND function3 is high AND function4 is low AND function5 is HIGH AND function6 is low THEN result is AVERAGE;

**Rule 3:** IF function1 is low AND function2 is low AND function3 is high AND function4 is low AND function5 is high AND function6 is high THEN result is AVERAGE;

**Rule 4:** IF function1 is low AND function2 is low AND function3 is high AND function4 is extreme AND function5 is high AND function6 is high THEN result is HIGH;

Here, the linguistic variable is assigned based on the range of values (0-5.03) as LOW, (5.03-10.07) as HIGH and (10.07 to 15.01) as Extreme. The fuzzy variables are assigned by the membership function. There are many membership functions and the selection of right membership function affects how well the fuzzy system approximates that functions. Here, the triangular membership function is used. Next to rule generation, the defuzzification process takes place to convert the linguistic variables to crisp values. The crisp values represent the score value between the original and the test documents. Finally the score values are obtained through the fuzzy logic for the text documents.
In this way the neuro fuzzy logic generates the relationship between the text documents based on the score values. After that, each test document will be provided with a threshold value. Then for the neuro fuzzy outcome with lower score value than the threshold, the content will be redistributed and re-examined. Likewise, the contents are provided to the learners on which the user is weak based on the score values which are lower than the threshold levels. If the user acquires score value greater than the threshold value, the next content on preference will be provided. The contents are utilized then to update the knowledge level of the learner. The above process is to be continued until the learner acquiring enough knowledge about the particular domain.

3.6.6 Concept Extraction

The process of concept extraction involves collecting the data obtained through Experts Recommendation, User Feedback, User Search Keywords, User Search History and User’s Browsing Catalog. For the user who are entering the adaptive teaching and learning system, the concepts are extracted. The adaptive teaching and learning system is stored with the user preferences through the learner profile ontology generation. Moreover, the concepts on which the learner is written with exams will be stored in the local instance repository, so that it is ease to assess the knowledge level (topic of preference) of users and thus extracting the suitable concepts. The extracted concepts can be utilized to draw a concept map using the JAVA Touchgraph software.

3.6.7 Concept Map

Concept Map (CM) is a graphical tool for helping learners to understand the concept relationships from viewing a summary, thereby reducing information overload and learning disorientation. For instructors, the
CM is a reference for designing materials. For learners, CM is a reference for guiding learning. Concept Maps will be arranged in a top-down hierarchy from high-level to low level. CMs are recognized as an effective knowledge-construction tool particularly in the fields of e-learning, including web-based learning, collaborative learning, mobile and ubiquitous learning, and game-based learning. The Figure 3.3 clearly shows the steps in concept map generation method.

![Figure 3.3 Concept map generation](image)

Concept Map can improve students’ ability to analyze and compile important concepts, relationships between concepts, and knowledge structure; it also helps teachers understand students' knowledge structure and the concept of error occurring with students. The concept map is generated based on the learned contents.

In this work, the concept map is generated with the extracted concepts. The generated concept map is utilized by the instructor to know about the appropriate contents on which the learner is skilled. The contents in the concept map will be updated for each and every online test. Thus the modification on concept map goes on continuously thus providing current knowledge status about the learner. The concept map can be generated for every user registering on the adaptive E-learning system. So that, with the help of concept map the instructor can view about the current knowledge level of every user without spending lot of time to know about the learner’s ability.
3.7 CONCLUSION

Learner profile ontology creation and Concept map generation for Adaptive E-learning using Fuzzy/Neuro Fuzzy has been discussed in this chapter. E-learning can be truly effective when it provides a learner centric adaptive learning experience. The success of any E-learning system depends on the retrieval of relevant learning materials according to the requirement of the learner. This leads to the development of the adaptive E-learning system to provide learning materials considering the requirements and understanding capability of the learner. This algorithm generates concept map based on the knowledge level of the learners through the ontology generation process, as the knowledge level varies for every learner. The generated ontology includes the user preference on topics and study material will be provided until user familiar with the topic. The learner will be provided with adaptive E-learning path by having least interaction with the instructors. The instructor should be able to know the current knowledge level of the learner through automatic concept map generation. The next chapter discusses about personalized learning system using ontology.