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Sistema Detector de Estilos de Aprendizaje en la Universidad de Guantánamo, Utilizando Técnicas de Minería de Datos

Learning Styles Detector System at Guantánamo University, using Mining Techniques Data

Carla Maria Alonso-Jane; Goar Orúe-Sánchez
Universidad de Guantánamo, Cuba
Correo(s) electrónico(s)
carlajane@cug.co.cu
goar@cug.co.cu

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Resumen

El diagnóstico del estilo de aprendizaje que predomina en cada uno de los integrantes de una brigada docente exige interactuar con ciertas cantidades de datos para efectuar un trabajo certero, repetitivo y mecánico. Esto se complejiza si se trata de ofrecer un perfil de aprendizaje de los integrantes de una brigada docente desde diferentes modelos. Para contribuir a resolver las situaciones mencionadas se utiliza un sistema de detector de estilos de aprendizaje, encaminada a elevar la eficiencia en la identificación de preferencias y características predominantes en el comportamiento de los sujetos en un ambiente de aprendizaje.

Palabras clave: Estilos de aprendizaje; Aplicación Web; Perfil de aprendizaje; Minería de Datos

Abstract

The diagnosis of the learning style that predominates in each of the members of a teaching brigade requires interacting with certain amounts of data to perform an accurate, repetitive and mechanical work. This is more complex if it is to offer a learning profile of the members of a teaching brigade from different models. To help how to solve the situations mentioned, a learning style detector system is used, aimed at increasing the efficiency in the identification of preferences and predominant characteristics in the behavior of the subjects when they are in a learning environment.

Keywords: Learning styles; Web Application; Learning Profile; Data Mining

Introduction

The term "style" defined it as "an internal quality in the behavior of the individual; a quality that persists despite the content of the information changing" ((Fischer & Fischer, 1979, p. 3).

In this research, Keefe's definition is used: "the cognitive, affective and physiological traits, which serve as relatively stable indicators, of how learners perceive, interact and respond to their learning environments" (1979, p. 4).

Currently there are different models and theories on learning styles; those that, from different perspectives, offer a conceptual and explanatory framework of the behavior of the person who learns and the type of didactic action that can be more effective at a given moment of learning.

Each student has his favorite environments, his special methods, his own motivations and objectives, his techniques for remembering, etc., all of which define in the individual a personal way of learning, that is, a style of learning.

In Universities, and in current contexts, the diagnosis of learning styles (even though this is approximate) constitutes an opportunity for the training process. This could contribute to the definition of teaching and learning strategies with greater effectiveness. Among other aspects, it is implicit in this, that the teacher enables his students to become aware of the learning styles they use predominantly. Help them develop others, in order to ensure optimal mastery of the analyzed content.

Starting in 2000, various tools emerged to describe and predict learning styles in students, the following aspects are taken into account:

• Tools for the Detection of Learning Styles in students using the Moodle Platform ", developed in the research group E-Solutions of the University of Cartagena. It consists of a software component that is compatible with the Moodle platform. This supports teachers of virtual subjects using the Richard Felder and Silverman test (Puello, Fernández & Cabarcas, 2014).

• "System to identify learning styles, through a virtual computer environment". It has been developed by students from the National Polytechnic Institute of Spain. Its objective was to develop a web page through which learning styles can be evaluated, through multimedia animations and questions that reflect real situations. The model used was the Peter Honey and Mumford test (Martínez Cruz, 2011).

• "Learning Styles Detector System at the Austral University of Chile", is the most recent in 2014. It consists of a web tool to detect the learning styles of a student or a group of students (course, cohort,

career, etc.) and allows the teacher to manage this Information. It admits the use of various questionnaires, statistics of the courses and suggests teaching methodologies for teachers (De la Maza, Álvarez-González, Vásquez, & Campos, 2014).

These tools developed to identify learning styles, do not use data mining techniques to identify student learning styles and organize them according to the results obtained.

However; in the following research:

- Data mining in mathematics education relationship between learning styles and academic performance (Martínez Valdés, 2011).
- Learning content management systems and data mining techniques for teaching computer science. A case study in the north of Coahuila (Olague Sánchez, Torres Ovalle, Morales Rodríguez, Valdez Menchaca, & Silva Ávila, 2010).
- Data mining to discover learning styles (Durán & Costaguta, 2007)..

Among others, they showed that the use of some treatment techniques and data mining applied to the results obtained from the tests, to identify learning styles, made it possible to determine with greater precision the degree of homogeneity in the learning style of the students.

In the previous research, no software was developed; instead, data mining tools such as WEKA were used.

Data mining is a field of computer science related to the process that tries to discover patterns in large volumes of data sets. It uses the methods of artificial intelligence, machine learning, statistics and database systems. The overall goal of the data mining process is to extract information from a dataset and transform it into an understandable structure for later use (Han, Kamber, & Pei, 2011).

In the present research, within the data mining techniques, grouping techniques are used that are responsible for grouping data within a number of preset classes or not, based on criteria of distance or similarity, so that the classes are similar each other and different with the other classes. Its use has provided significant results for pattern classifiers or recognizers, such as in modeling systems. This method, due to its flexible nature, can be easily combined with another type of data mining technique, resulting in a hybrid system. (Witten, Frank, & Hall, 2011).

The results of the professional training process at the University of Guantánamo (UG) showed that the Faculty of Engineering and Technical Sciences (FICT) does not have the best teaching and permanence results at the university. Therefore, it is necessary to continue perfecting the teaching-learning process

developed by the different careers studied in this faculty. One aspect of improvement may be to achieve greater precision in characterizing the individualities of students in the learning process they develop. A significant element of such characterization is achieved with knowledge of the respective learning styles.

For the professors of the courses studied at the Faculty of Engineering and Technical Sciences (FICT) belonging to the University of Guantánamo, it would be useful to have technologies that facilitate and stimulate the profile characterization processes of the main learning mechanisms they use the students. This would allow an improvement of the teaching strategies that are used.

To address this problem, it is proposed to use the theory of learning styles, which is considered one of the tools with certain effectiveness in the process of learning orientation. This theory could provide treatment strategies and analysis of learning styles which would be solid and simple guides to keep dropout and failure rates low.

The application of the test corresponding to one of the learning style models makes it possible to characterize the different alternatives corresponding to the model, which each student uses. For the computerized processing of the tests corresponding to the Kolb and Felder – Silverman models, mechanisms have been proposed to determine the reliability that measures the internal consistency of the instrument corresponding to the model. The use of data mining techniques allows a better characterization of individual learning mechanisms and the development of better associated teaching strategies.

The need for teachers consists in the lack of a tool that efficiently allows characterizing the main alternatives of a learning model, predominant in the students served.

Naturally, the aforementioned is especially related to the planning alternatives of the teaching process activities that increases their effectiveness.

So the objective of the research is to develop a computer application that allows characterizing the learning styles of students.As a contribution, a web application is obtained that allows teachers to characterize the learning style of their students. This tool can be accessed by registered users, from the website of the Faculty of Engineering and Technical Sciences, of the University of Guantánamo. It makes it easier for teachers to make decisions about their educational practice, after obtaining the results of the profiles to which their students belong, so that they can use teaching methodologies that include resources oriented to the learning styles they require. In addition, it offers the teacher

information that can be used in decision making to make or not changes that favor the performance of their students.

Development

The learning style detector system at Guantanamo University uses techniques of Data mining, is a web application that offers the possibility of identifying preferences and dominant characteristics in the behavior of the subjects when they are immersed in a learning environment. The application is made up of a set of pages that allow access to two learning style questionnaires; once they are answered, different traits that act as relatively stable indicators of the behavior of the surveyed subject when learning are immediately known.

More specifically, what is achieved is the computerization and automation in the application and processing of questionnaires of learning styles through the use of computer technology, offering to the main organizational levels for the educational teaching process at the University of Guantánamo a learning profile of each of the students of the different careers, which constitutes a starting point for the design of learning activities.

- **Brief description of the system**
- • **Home:** the home page is in charge of welcoming users, giving them information about the purpose of the system. In addition, as part of this page an authentication area is displayed that will allow registered users to access the other services offered by the system.
- • **Basic module:** this module is started through the initial interface of the system, the menu of this module shows three buttons: Start, Create profile and Contacts, these buttons will lead the user to different pages, in which they can perform a set of basic actions and inherent to every initial or registered user that uses the system.
- • **Create profile:** the create profile page will allow the registration of all users who use the system for the first time, which is necessary to access the services it offers.
- • **Module for teachers and students (General):** as part of the general features of the system, the menu for the module of teachers and students shows five buttons: (Start, View Profile, Questionnaires, Contacts and Close session).
- • **Start:** coincides with the Start interface of the basic module, except that in this case user authentication will not be necessary.

- • **View profile:** the View profile page is responsible for communicating to users everything related to their information within the system, which has been provided by the user at the time of creating their profile; this page will also be responsible for displaying the results achieved by the user when answering the questionnaires offered in the system**.**
- • Questionnaires: the Questionnaires page is in charge of communicating to users everything related to the questionnaires to be carried out, providing each one with an informative table offering their usefulness. To access one of the questionnaires, just click on the Access button and the system will automatically take you to the page of the selected questionnaire.
- • Close session: the user can leave their session if they so wish; once you have left the session, you will return to the Home page.
- • Module for teachers (Specificities): as part of the specificities of the system, the Teacher role incorporates the (Query) button in the menu, this option will lead this user to a query page that will allow him to know the Style of Learning of the students registered in the system depending on certain socio-academic parameters (Course types, Careers, Years and Group).

Requirements for working with the system

• Basic knowledge of how to use the computer and web browsers.

• Have at least one web browser installed (Mozilla Firefox, Opera, Google Crome or other).

• Have installed at least one software for processing PDF files (Adobe Reader, Foxit Reader or other).• Client PC (minimum requirements): the system can be operated on client machines with a Pentium III processor at 1.5 GHz speed, 256 MB of RAM and a 10/100 MB Ethernet network card.

• Server PC (minimum requirements): the system will be installed on a server PC with Pentium IVA 2.5 GHZ processor speed, 512 MB of RAM, 20 GB of free hard disk space and a 10/100 MB Ethernet network card.

• The server PC where the system will be installed must have a web server and the database server.

Technologies used that support the proposal

This section provides an explanatory tour through the study of the technologies that were used for the development of the proposed system.

Apache Web Server: A web server is a computer program that processes a server-side application by making bidirectional and / or unidirectional, synchronous or asynchronous connections with the client, generating a response in any language or application on the client side; the code received by the client is usually compiled and executed by a web browser. As part of the proposal it was used in Apache web server, this is an open source HTTP web server for Unix platforms (BSD, GNU / Linux, etc.), Microsoft Windows, Macintosh and others, which implements the HTTP / 1.1 protocol. and the notion of virtual site; its modular design provides a high degree of quality and strength for the implementation that uses the HTTP protocol. Apache has great universal acceptance and due to its potential, it is used in 70% of the world's websites; it is a flexible, fast, extensible and efficient web server, continuously updated and adapted to new protocols; it easily adapts to different environments and needs with the different support modules it has, it also supports a large number of languages such as PHP and provides information content with a place to be available in a safe and reliable way.

Server-side language (PHP) These are languages that run on the server side, they process user requests by interpreting a script on the web server, ultimately generating dynamic HTML pages in response. For the implementation of the system the PHP language was used, it is free and fast, with a large library of functions and a lot of documentation, it is also a language interpreted and embedded in HTML, supported by most of today's web servers nowadays, as Apache PHP is completely oriented to the development of dynamic web applications with access to information stored in a database, it also has the ability to connect with most of the database engines that are used today, highlighting its connectivity with MySQL; it also enables developers to engage with dynamic content applications without having to learn a whole new set of features, drawing attention to its extreme simplicity for the beginner, but in turn offering many advanced features for professional developers.

Client-side languages

These are languages that run on the client side, they are interpreted by the browser, finally generating static or dynamic pages in response, making it possible in most cases to improve the user interface. Below are the client-side languages used for the development of the system.

HTML 5: is the fifth version of the basic language of the w.w.w (World Wide Web) HTML. HTML is a content markup language for the elaboration of web pages, in its standard it defines a basic structure and a code to establish the content of the web page, such as: text, images, forms and controls. HTML5 establishes a series of new elements and attributes that reflect the typical use of modern websites. Some of these new elements are technically similar to previous labels but have a different semantic meaning,

other elements provide new functionalities through a standardized interface, such as the audio, video and canvas elements (capable of rendering in major browsers such as Mozilla, Chrome, Opera, Safari and IE 3D elements). There is also a renewed emphasis on the importance of DOM scripting for web behavior. 2.0.

CSS3: is one of the latest style sheet language specifications used to describe the semantic presentation (appearance and format) of a document written in markup language, such as HTML. CSS3 has a very simple syntax that is made up of a list of rules, each rule consists of one or more selectors and a declaration block with the styles, to be applied on the elements of the documents that comply with the selectors as well as their specifications. previous; a whole set of new functionalities are added to this syntax. The use of CSS presents a set of advantages such as centralized control of the presentation of a complete website, which considerably speeds up its updating; It also allows the content of the presentation to be separated, which makes it easier for the creator or designer to modify the document display without altering its content.

Java Script: it is an interpreted programming language, that is, it does not require compilation, it is imperative, dynamic, object-oriented, based on prototypes and multiplatform, its code is included directly in the same document allowing improvements in the user interface. Thanks to its compatibility with most modern browsers, it is one of the most widely used client-side programming languages. With JavaScript, much of the programming is focused on describing objects, writing functions that respond to mouse movements, openings, use of keys, page loads, among others, allowing you to create special effects on pages and define user interactivities. The client's browser is in charge of interpreting the JavaScript instructions and executing them to carry out these effects and interactivities, so the greatest resource available to this language is the browser itself.

Database Management System (MySQL): Database Management Systems (DBMS) are a very specific type of software, dedicated to serving as an interface between the database, the applications that use it and the user. The persistence of system data is based on the bases of the use of MySQL, it is a fast and solid relational database administration system; it is widely used in web applications, in operating systems like Linux and Windows and in web servers like Apache; Furthermore, its popularity in web applications is closely linked to PHP. The databases it stores allow you to search, sort and retrieve data efficiently. MySQL has several advantages among which is its high performance in web environment applications, its low cost, ease of installation, configuration and customization; It is also an open source DBMS, with great worldwide popularity.

Conclusions

The development of this work corroborates the important role that computing can play in terms of generating applications that contribute to improving the results of the teaching-learning process in the different educational institutions; all of which is reverted to the benefit of the economic and social development of our country. The Learning Styles Detector System software at the University of Guantánamo, using data mining techniques, constitutes a tool that facilitates obtaining a learning profile for each of the students and for each of the teaching brigades that make up the Computer Engineering degree, from the University of Guantánamo. In other words, a contribution to student-centered learning, since teachers can make a more detailed analysis of their students and establish individual and group learning strategies.

Bibliographic references

De la Maza, M. E., Álvarez-González, L. A., Vásquez, C., & Campos, A. (2014). *Sistema Detector de Estilos de Aprendizaje en la Universidad Austral de Chile*. *Nuevas Ideas en Informática Educativa*. Universidad Austral de Chile.

Durán, E., & Costaguta, R. (2007). *Minería de datos para descubrir estilos de* aprendizaje. *Revista Iberoamericana de Educación*, (6), 5-9.

Fischer, B. & Fischer, L. (1979). Styles in Teaching and Learning. *Educational Leadership*, 245-254.

Han, J. & Kamber, M. (2011). *Data Mining: Concepts and Techniques* (3rd Edition). The Morgan Kaufmann Series in Data Management Systems.

Keefe, J. W. (1979). *Learning Style: An Overview*. *Student Learning Styles: Diagnosing and Prescribing Programas National Association of Secondary School Principals*. Recuperado de https://www.eric.ed.gov/?Id=ED182859

Martínez Cruz, A. (2011). *Diseñan software para identificar estilos de aprendizaje.* Recuperado de http://www.parentesis.com