



A FRAMEWORK FOR SUPPORT ON GENERATION OF MASSIVE OPEN ONLINE COURSE – ADAPTATIVE MOOC USING TECHNIQUES OF CONTEXT ADAPTATION

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ABSTRACT

This paper presents a proposal for a software framework to aid in the development of adaptive MOOC, using techniques adapted to the context. This solution will support the adaptation of the content of MOOCs according to student's profile and preferences. This adaptation is performed in a dynamic way, creating content tailored according to the learning style of each student, generating different materials according to their profile. Aiding in better understanding of the content by the student, allowing the reduction of avoidance of these courses.

Keywords

MOOC, Distance Learning, Adaptation, Techniques of Context Adaptation.

Academic Discipline And Sub-Disciplines

Education; Learning Distance; Program Language

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INTRODUCTION

Immersed in a evolutionary educational scenario, due to easy access to information through internet and with constant appearance of new digital technologies, the society requires new learning possibilities, especially those supported by Internet [1].

This innovative context pushes the potential to connect people, placing them in a collaborative production way, allowing acceleration in educational development, decreasing the fine line between learning, institutions and geographic locations.

One of the greatest benefits arising from such evolutions is the increase of Open Education, which means, what was before restricted for small groups of people started to be made available via internet for “everybody” [3].

However, this educational (r)evolution comes making questions to methods and techniques used in formal education, in which curricular structures are rigid, far from reality and with no space for the student to create its autonomy.

In the middle of this evolutionary context, Massive Open Online Courses – MOOCs arise, to attend the necessity of changes in educational paradigm, which can be considered the next step on distance courses.

According to [4], MOOCs are, in essence, large teaching courses (there are no limits of participants), where people interested in a particular subject reunite to learn in a collaborative way, using Open Educational Resources (OER), such as: Social Networks, Blogs, Twitter and other Internet resources, without restrictions of participation or prerequisites (normally this courses are free and there is no registration fee, being done by any person with access to Internet anywhere in the world).

Yet, the challenges for MOOCs to be a reality in present and future are countless, like: extremely heterogeneous universe of users, cultural diversity, different languages, domain on technological tools, lack of certification, high evasion rates and fragmented knowledge are some of the great barriers that this new and promising modality of courses will have to break.

For [5], the big challenge the MOOCs face is the fact that there is only a few, or almost nothing, in knowledge on students registered in these courses.

As to [6], raises another important question regarding MOOCs, the fact that the learning ways vary for each student, how they answer to social and pedagogic contexts and their personal way to deal with challenges.

Another considerable vulnerability of MOOCs is in the high dropouts rates, as can be seen in these two examples: a) The Electronic Circuits of MIT, which initially had 155,000 (a hundred fifty five thousand) students registered, with a percentage of only 5% (five percent) graduates; b) The Artificial Intelligence course, taught by Peter Norvig and Sebastian Thrun, had 160,000 (a hundred sixty thousand) registered and finished with only 14% graduates [7].

In such scenario, it is a challenge to develop applications that contribute for the MOOCs to break the barriers, especially when referred to the students' heterogeneity, their learning preferences and cultural diversity.

This paper proposes an architecture for content customization of MOOCs, autonomously, in other words, without user intervention, by means of software infrastructure, facilitating the development of adaptative MOOCs to the student's profile.

2. ADAPTATION

The Concept shown by [8] is that adaptation is the capacity of adequacy which an application has to adapt over the changes on environmental circumstances that executes.

Two factors have contributed for an increase of interest for the development of adaptative softwares: the development of autonomous computing, whose purpose is to increase the systems with capacity of self management, using all potential of technological infrastructure, reducing human administration on them; and mobile computing paradigm, in which the applications must have the capacity to adapt in different environments and mobile devices [9].

An application can be considered adaptative if it is capable of changing automatically its behavior according to the context [10].

For the MOOCs contents to adapt distinct profiles from users, a careful selection is necessary of content that must be adapted to learning style of each student.

Therefore, the same content sent to a student cannot be sent to all students in the same way, for example. In this context, an adaptation will be made on the content and interface, when necessary. This process is presented in the operational structure of the paper item (4.).

2.1. Content Adaptation

The content adaptation, in this paper, is based on stereotypes in which the students are classified according to their cognitive or learning styles [11].

According to [12], the cognitive styles are cognitive strategies forms the individuals use in information coding.

As in model proposed by [13], the cognitive styles of a student is comprised in six styles, the following:

- a) Thought convergence;
- b) Thought divergence;
- c) Holistic;
- d) Serialist;
- e) Reflexive and;
- f) Impulsive.

For the cognitive style of the student to be identified, the last will need to answer an initial questionnaire, after logging in. This phase will allow their actions to be registered and monitored.

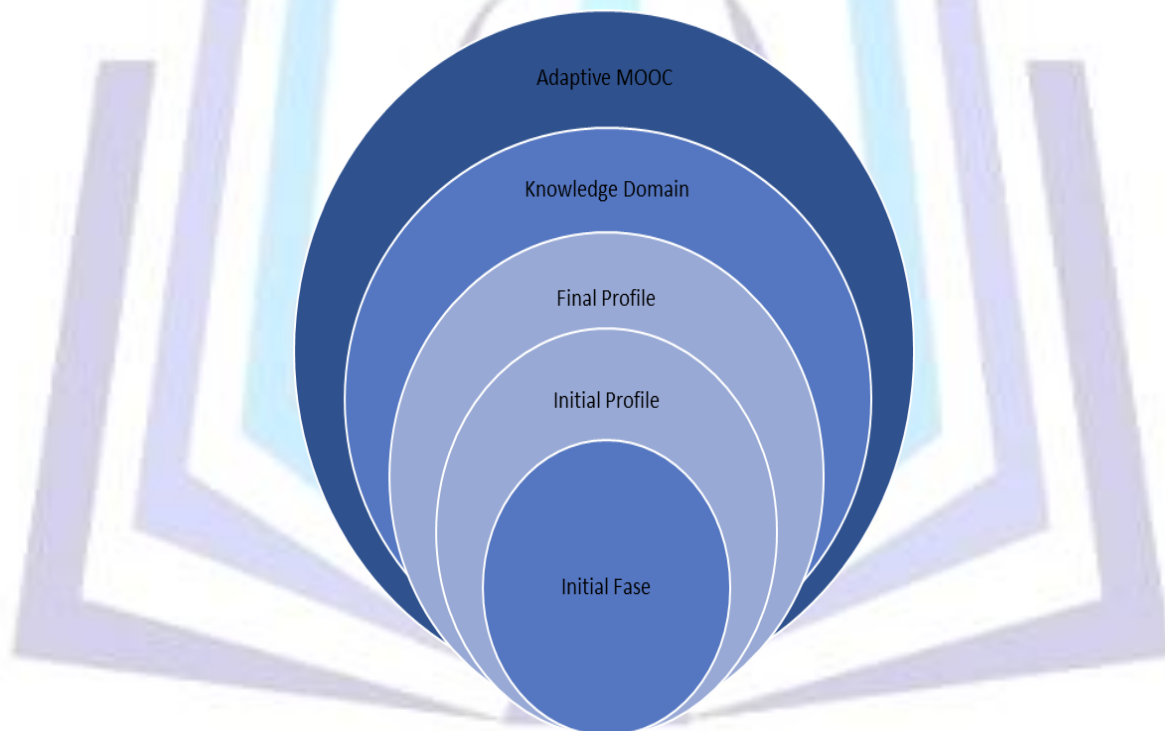
3. Proposed Architecture Overview

The architecture proposed to generation of adaptative content of MOOCs uses adaptation techniques of context in the execution of this customization, in such way that the students participating in these courses are answered dynamically, providing an adapted content, covering their cognitive and learning profiles.

This solution intends to reduce the time of development and will allow the content customization of MOOCs, through a methodology based on layered development, facilitating future changes and improvements.

The aim is to obtain a solution multi-platform capable to perform content adaptation of MOOC automatically, using as base the context user information.

Figure 1 illustrates the phases in the proposed model, to perform the adaptation process.



1 – Fases in proposed model

The proposed model uses requirements of ISO 9241 – 11, 1998. To fill these requirements the model is composed by five phases, following:

- a) Initial Fase - Analyze previously the student's profile: questionnaires regarding preferences will be used, previous knowledge, in order to determine the cognitive style;
- b) Fase 2 – (Initial Profile) – Generates the initial profile of the student: the answer base obtained by the questionnaires will be used to frame the student in a cognitive predominant style, used to perform the content adaptation to their profile;
- c) Fase 3 – (Final Profile) - Generate the final profile of the student: The profile will be generated when the student finish the first step proposed by the chosen course. Using for this the information base obtained in fase 2, together with their browsing preferences;

d) Fase 4 – (Knowledge Domain) - Generate the knowledge domain of the student: an information base will be generated with initial and final profiles of the students, which will be used as reference for the model to improve the profile of this student, using previous knowledge. These information are directly connected to content to be learned (domain); and

e) Final Fase (cMOOC Adapted) – Perform the content adaptation of cMOOC: in this fase, the base on generated knowledge from earlier fases will be used, to perform the content adaptation to user profile.

3.1 Proposed Architecture

The proposed architecture uses the separation of layered application. This solution allows the inclusion or exclusion of new functionalities, processes or layers with minimum impact in architecture. Apart from facilitating and making more efficient the development process, (by code reuse) it allows the solution to be improved easily [14].

Figure 2 demonstrates the Adaptation Framework, to validate the proposed model.

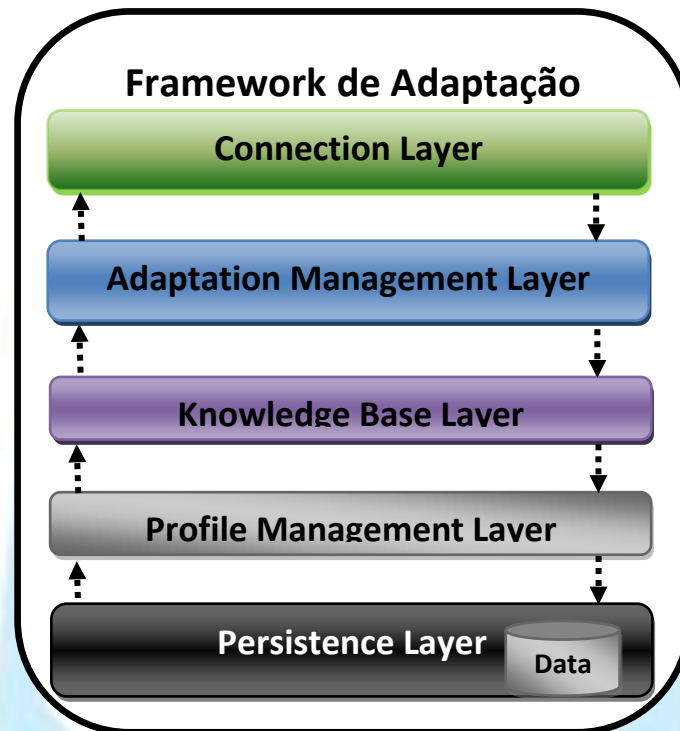


Figure 2 – Proposed Framework

This Framework is composed by 5 layers: Connection, Adaptation Management, Knowledge Base, Profile Management and Persistence.

The activities executed by the layers belonging to Adaptation Framework are described afterwards, following:

1º. *Persistence Layer*: responsible by the storage of information about the student (initial profile, complexity level), as well as cMOOC content, aiming the their integrity.

2º. *Profile management Layer*: uses information from lower layer to generate base of preferences (based on their browsing), knowledgements (using questionnaires) and students' final profile, in a pre-defined way.

These profiles are a set of specified characteristics of students, used to identify their learning preferences (they are generated, administered and stored by the layer. In order to generate these profiles, a set of pre-defined rules has been used.

3º. *Knowledge Layer Base*: has as objective to collect students in groups with common characteristics (according to initial and final profile), using the information from Managing Profile Layer. Such information serves as reference for the model to improve the student's profile, based on previous knowledge, generating the formative itinerary according to the profile of the student.

This process will facilitate its management and the control on information change between server and cMOOC, reducing then the necessary processing for the management of this task and ensuring integrity in this process; and

4º. *Adaptation of Management Layer*: this layer determines the strategies used for the performance of content adaptation of cMOOC, using for this aim, sensitive techniques to context. Using the information from previous layers, that the same content is adapted to different students' profiles.

5º. *Connection Layer*: the last architecture layer that has the responsibility to receive, store, manage and keep the connection references made with users and cMOOC.

This layer also executes the process of user identification in execution time, using the information received from Knowledge Base layer.

4. Prototype Operation

The adaptation Framework uses initially the information base concerning user, acquired using the questionnaires to identify the student's profile, generate groups according to profile. This initial step of group generation according to profile can be observed in figure 3.

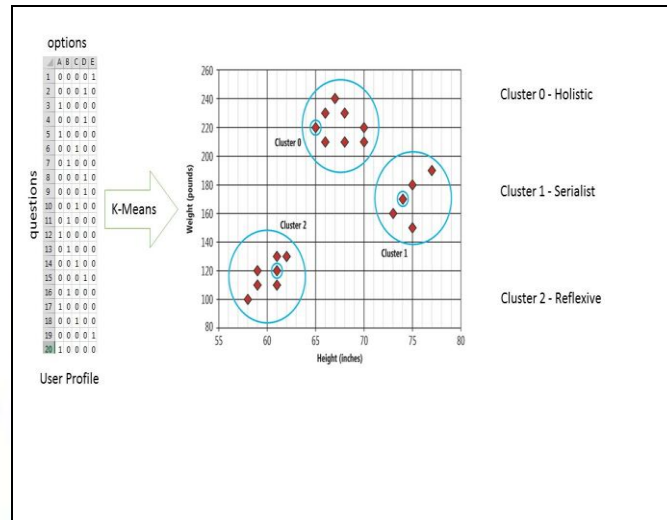


Figure 3 – Initial step

Afterwards, according to the student's profile, to facilitate the management of a large number of users, they will be managed by groups created according to their profile.

The group management will allow a smaller information processing in the system facilitating the information management.

According to user's interaction with the system, will be analyzed their browsing preferences, which will help the final profile definition of the student.

This process is illustrated in figure 4.

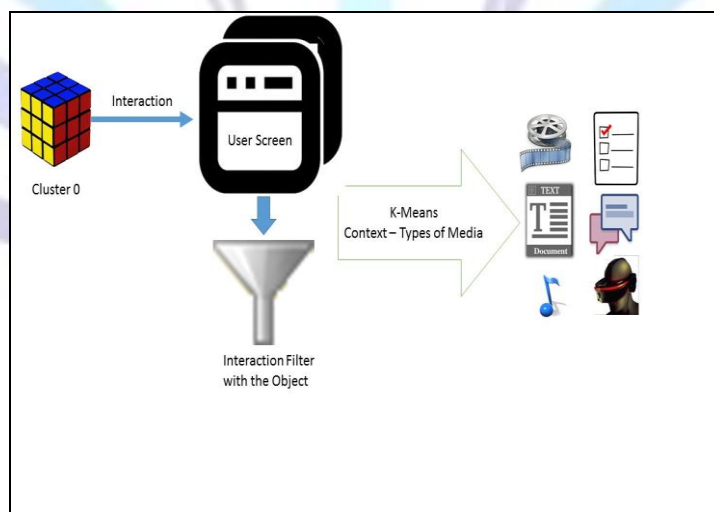


Figure 4 – Management of student's interaction

After these processes, the Student's Domain will be obtained and later, the content and interface adaptations will be performed, adjusting the environment of the student's profile, as can be seen in figure 5.

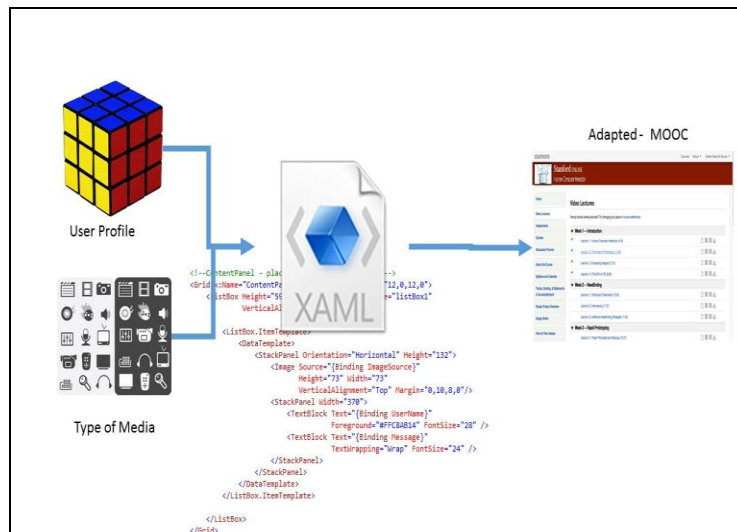


Figure 5 – Adaptation Process

The Student's Domain is composed: by cognitive style and student's preferences.

5. Considerations and Future Works

This paper presented the proposal of a Framework, in development, to support the content adaptation of MOOCs according to user's profile.

The solution presented in this paper enables the identification of user's characteristics, based on pre-defined profiles without the intervention of the user, provides enough information to perform the content customization and adaptation.

Tests have been made to define the user's profile, using context adaptation techniques, according to the initial rules of adaptation.

The use of development model in layers facilitate the evolution of the proposed architecture.

As future work, more tests will be made with adaptation strategies according to the user's profile, and application of these strategies for the management of groups of users with the same characteristics, for example.

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