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The Contribution of AI for SPOCs in Language Learning. The Example of SPOC+

Asgari Hamed*

Laboratory LIDILEM Université Grenoble Alpes, France

Antoniadis Georges[†]

Laboratory LIDILEM Université Grenoble Alpes, France

ABSTRACT

The lightning speed of the progress in communication and teaching technologies and the emergence of mobile artefacts offers us the opportunity to propose a teaching system of the French language through natural language processing tools in a modular way. Being able to integrate the technologies of artificial intelligence adapted to teaching in the continuity of the MIRTO project, to allow the creation of a platform for 100% distance learning through Small Private Online Course for different levels of learners for learning French as a foreign language.

CCS CONCEPTS

• **Applied computing**; • **Education**; • **Distance learning**; • **Computing methodologies**; • **Artificial intelligence**; • **Natural language processing**;

KEYWORDS

SPOC, NLP, MIRTO, MLEARNING, SPOC+, IA

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1 INTRODUCTION

Mobile technologies are reshaping learning and teaching by supporting, developing and enhancing course content, learning activities and student interactions with the instructor, peers, and learning content [1, 34]. Combining technological advances and facilitation of teacher’s tasks while at the same time bringing the opportunities of new technologies such as the use of Natural Language Processing (NLP) and Artificial Intelligence (AI). Technologies help to overcome many limitations and barriers of traditional teaching such as lack of opportunities to use the language, individualized learning or feedback and learner interaction [2] to enable a seamless learning experience: learning anytime, anywhere [24]. Small Private

*Corresponding E-mail: Hamed.Asgari@univ-grenoble-alpes.fr

[†]Corresponding E-mail: Georges.Antoniadis@univ-grenoble-alpes.fr

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Online Cours¹ becomes an innovation of the teaching model and constitutes a new form of information-based teaching. Currently, several theories and different educational practices of the SPOC are available [14], in various disciplines and educational sectors for different university levels, they are not widely used, as they can only be found in reputable universities [23]. A series of recent studies has indicated, by encouraging participation and stimulating learners’ interest in learning, SPOC is more attractive than traditional courses [11]. According to the literature, there is no scientific functional system which has been realized on the use of SPOC in language learning with the integration of NLP tools for mobile artifacts. Purpose of this study is to provide an integration possibility of AI solution in SPOC+ [6] as an innovative French language learning system based, integrating NLP tools in the pursuit of the MIRTO² project [5] on mobile devices with a personalized follow-up procedure for each learner. AI Integration should let us to improve the quality of the existing system and to make possible the creation and verification of distance learning exams to have a reliable tool for 100% distance learning. Given the complexity and variety of learners, if mobile learning (m-learning) platform cannot involve AI, it will lead to learners failure and demotivating and subsequently damage the platform itself.

2 EDUCATION AND NATURAL LANGUAGE PROCESSING

Education and learning have begun since the birth of the human being. According to Molnar “educational technology, especially computers and computer-related peripherals, have grown tremendously and have permeated all areas of our lives” [27]. Education is a multidisciplinary field; by mixing different domains such as didactics, educational science and computer science. NLP and AI modelling have played a significant role in the design, implementation [15] and development of our thinking about computer-assisted language learning (CALL). Our approach to NLP is in the continuation of the MIRTO project which was invented by Georges Antoniadis [5] in 2004. The objective of the MIRTO project is the design of a multilingual system for language teaching. It is an environment and a tool for expressing and implementing proposals and solutions for problems related to language teaching for language teachers. According to Antoniadis, MIRTO’s objectives are:

-The set of NLP software resulting from scientific research and laboratories.

-The diversity and richness of textual and oral corpora.

-A set of NLP functions (NLP function is obtained from NLP software) [4]

¹SPOC

²Muti-Learning Interactive through Text and Oral Research (in French Multi-apprentissages Interactifs par des Recherches sur des Textes et l’Oral)

According to Detmar Meurers, “the use of NLP in the context of learning language offers rich opportunities” [26], therefore we can use NLP to analyze learner language and analysis of native language. One of the first challenges in online teaching is the interaction between the teacher and the learner. In order to facilitate the exchange between them, we will integrate the SPOC as “post-MOOC³ era” [11], that we will present later and discuss the advantages of this new trend in teaching that can be used by learners with different levels as well as at the university, K-12 or for anyone interested in learning.

3 SPOC+

With the progress of new technologies and new tools at the disposal of learners, it seems obvious to adapt the way of teaching. There is a need to change the traditional mode of teaching in which the teacher is able to connect or even not interact with the learners, which diminishes the capacity for autonomous learning. The new teaching model is rising and therefore the ancient offline course and online teaching are perpetually being integrated and updated [22]. In this way, we based ourselves on the SPOC, the new model in distance learning, which was invented in 2013 by Armando Fox [13] at the American University of California at Berkeley [11], and we integrate different modules and improvements such as MIRTO project, the use of AI, geolocation, virtual reality and augmented reality. SPOC+ is the name of our platform. Simply, the “S” refers to “Small”, which defines a pre-selected group of learners based on pedagogical criteria consistent with the whole class and the proposed course, limited [19:444] to a maximum number of 25 learners, which is different from MOOC, which has thousands or tens of thousands of participants. Particularly the initials “P” refers to “Private”, which is a paid course that is not intended for a large scale of learners, and which could improve the effectiveness of learning and completion of the course by the learners and provides a different learning experience for learners [23]. Obviously, “O” is the acronym for “Online”, which allows learners access to the course content at any time to allow them to adapt it to their convenience while respecting the instructions given beforehand on this subject. We have integrated chat and forum tools that are usable for learners of the same course. Here, in contrast to MOOCs, the teacher who gives access to these forums to each learner by providing them a topic to exchange between learners, allowing exchange and group work according to progression. The chat module only can use between the teacher and an individual learner, which provides a personalized follow-up in synchronous or asynchronous mode and avoids the traditional exchanges which were made on tools of this kind. The chat and forum modules allow teachers to interact and act directly in the whole learning process of the learners, which is one of the advantages of SPOC [22]. Learners will be able to transfer different document formats between themselves and their teachers using chat tools and forums. Clearly, letter “C” indicates the “Course”, which is the core of a learning process. We incorporate the notion of project-based pedagogy proposed by John Dewey [12] for our courses. In these courses, we use video materials, which are maximum 15 minutes for each one, the time required to achieve each lesson is no more than 70 minutes. A detailed information sheet is associated by the

teacher with each lesson, providing clear, useful and simple information about a title, an abstract, some keywords, prerequisites, an estimate of the required working time, expected objectives and of course the date of the last update in order to familiarize the learner before starting the lesson. The learning process has to organize by a teacher or a group of teachers to achieve a pre-established objective, according to Stephanie Bell [8] “Project-Based Learning (PBL) is a student-driven, teacher-facilitated approach to learning”. Positively, “+”, represents all that we bring to the SPOC set, such as the use of a morphological analyzer as NLP tool and the adaptation of the MIRTO project to be usable on mobile artifacts, as well as the integration of AI solutions that we will explain later during the presentation of the SPOC+ architecture. Actually, SPOC has become a completely new form of education, combining the new information era with the latest educational resources.

4 NLP & SPOC+

Our areas of work are in the field of computer-assisted language learning (CALL) and NLP in the framework of the MIRTO project for an adaptation of MIRTO’s m-learning capabilities. The main objective of SPOC+ is the defining, conceptualizing of the architecture and developing a system for teaching French as a foreign language to non-French speakers on mobile devices with the concept of SPOC. The integration of the auto-creation, as well as the correction of exercises in our solution, is basing on the previous work of MIRTO, which integrates a morphological analyzer. According to the main work of Gorges Antoniadis, MIRTO is able to integrate classic NLP functions within the platform to facilitate the creation of didactic activities without prior computer skills [4]. To generate automatically the activities, we use the morphological analyzer TeeTagger which comparing to Brill is a multi-platform, open-source and available for windows. The reliability rate of TreeTagger [30] is 95.7% which is 1% higher than Brill by 94.6% [3]. In the continuation of the MIRTO project, we have adapted TreeTagger and 33 different labels to automatically generate MCQ exercises, texts with holes, grammar, conjugation or spelling. Through SPOC+, oral/written comprehension and oral/written production, all four necessary skills for language acquisition, are offered to the learner. Generally, students have positive perception from learning a language with a cellphone which has positive effects on language skills [31].

5 AI & M-LEARNING

As Stefania Giannini, Assistant Director-General for Education at UNESCO⁴, points out “It is education that powers sustainable development, and this will only succeed if it leverages the digital revolution and in particular AI” [38]. New opportunities for education were offered by the rapid advances in information and communication technologies [28]. Fortunately, on the other side, with the development of the mobile wireless networks such as 5G and modernization of mobile communication equipment in recent years, we can have access to the m-learning solutions anywhere at any time [25]. According to Statista, 44.98% of the global population owns a smartphone which is equal to 3.5 billion unique users in worldwide [39] that lead to extend learning beyond the traditional classrooms [35]. These items provide opportunity for m-learning

³Massive Open Online Course [20:433]

⁴United Nations Educational Scientific and Cultural Organization

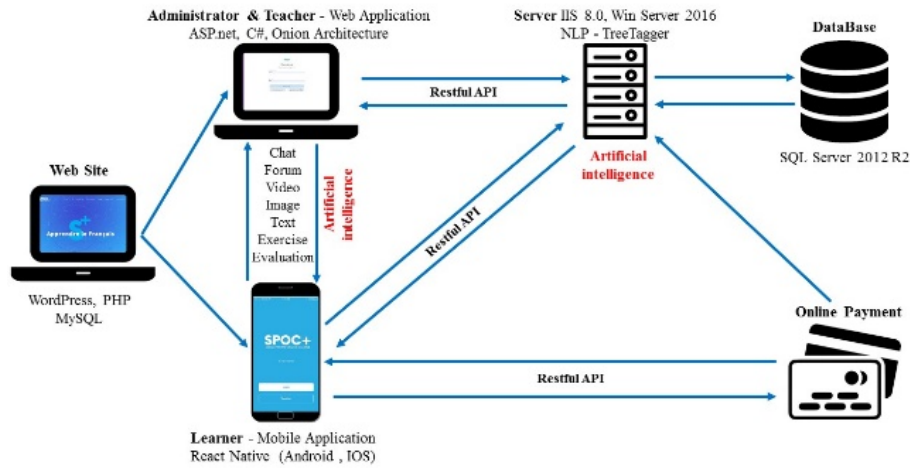


Figure 1: AI solution in SPOC+ platform.

that able to adapt solutions for different online training courses that do not require considerable effort from the teacher’s side for technical subjects (computer or telecommunications) and will allow teacher to focus on the teaching and pedagogy which is necessary for learning. In this process, AI is the best way to customize the use of the application [10]. The development and deployment of AI attract varied fields, including the world of education. Nowadays, AI techniques used in education are like supporting the various interactions and exchanges with learners [37] while proposing activities that are better adapted to their weaknesses and strengths as they progress through their educational path. According to Mike Sharples [32], mobile learning movement, also called m-learning, invented by Alan Kay with Dynabook emerged in 1970s. There are several definitions for m-learning but there isn’t any exact consensus on this subject, however, we can distinguish some of them:

- “Any sort of learning that happens when the learner is not fixed predetermined location or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies” [33].

- “Learning supported by mobiles device such as cellular (mobile) phones, portable computers, and personal audio player” [29].

- “Learning by means of wireless technological devices that can be pocketed and utilized wherever the learner’s device can receive unbroken transmission signals” [7].

The devices used for mobile learning may be different and change over the time, but the term of mobility in all definitions is the only one that does not change. In this article, we propose to focus on the term of mobility for mobile artifacts, the dimension of distance and the use of telecommunication technologies. We define smartphones as new generation of mobile devices that in addition to today’s standard features are able to communicate from almost anywhere, can provide new functionality as long as they pick up a signal that allows them to access the internet and install third-party applications.

As for the definition of AI, there is no precise consensus, but we retain that it is a science of research, design and development and the application of intelligent systems and machines to aid and enhance the capacity of human intelligence [25]. We are in the way that the machine cannot replace the human, it can help the human to improve but a total replacement is not possible. The development of digital technology has greatly diversified teaching and learning strategies [36], such as those related to personalization [9].

6 AI AND SPOC+

As previously mentioned, SPOC+, is the evolution of the MIRTO system including m-learning to obtain a French language learning system with a complete architecture usable on mobile artifacts. The whole SPOC+ system is composed of two websites and an application dedicated to the smartphone (Android and IOS) developed in React Native language. The architecture build in such a way as to be able to add new functions or NLP modules and keep up with technological developments and updates. Consists of three interfaces for administrative staff, teachers and learners modules for activity generating, correction, morphological analysis and feedback. The secure web application is only intending for teachers and administrators that caused learners just interacts with the software on the smartphone (see Figure 1).

As displayed, the AI can influence in two different parts of our platform:

- Back side
- Front side

6.1 Back side

SPOC+ collects and records all the information and exchanges between the learner-teacher and the behavior of the latter two throughout the course in its database. AI can use to improve the results of the morphological analyzer to allow simpler exercise creations with better results. Also, can diagnose student errors, analyze the causes of errors and take corrective action and enable

the teacher to continuously improve teaching strategies through the process of project-based pedagogy. SPOC+ is a modular system, to progress in the use of AI possibilities for learning, it is possible to easily add new functionality.

6.2 Front side

The recognition of human emotions such as disgust, joy, anger, surprise, fear or sadness can be achieved through the process of mapping facial expressions to identify emotions from real-time to static images, several algorithms, solutions and applications already exist but need to be perfected [20:61]. AI can provide solutions to facilitate facial recognition. According to a recently published study by Juniper Research, by 2024 facial recognition hardware will be deployed in 90% of smartphones [40]. GaussianFace, the facial recognition algorithm developed by The Chinese University of Hong Kong has a success rate of 98.52% as opposed to 97.53% achieved by human beings. With the new smartphones equipped with facial recognition technology, AI can develop and integrate the evaluation of learner behavior, with this tool that is becoming more and more widespread.

To carry out online exams and eliminate possible cheating by learners for distance certification, the role of AI is to integrate the Secure Exam Management System (SEMS) tools proposed by Hervé B & Eugène C [17] which offer random face recognition and Global Positioning System (GPS) location of the learner's smartphone. In this section, we propose to integrate Bluetooth technology, which is also present in most smartphones such as GPS to improve the minimum required distance between students, even if we have learners who are in the same GPS location or the places where GPS signals will not pick up by smartphones.

7 CONCLUSION

The main conclusion that we can refer here is the role of the AI in the backside and front side of SPOC+, that be able to allow to both of the teacher and the administrative core to promote exercises adapted to each learner by analyzing the data.

Besides, AI-based platform helps teachers and students to focus on what they need to teach and learn. New developments in AI such as facial recognition will be considered to limit the problems of distance education and to provide a tool to secure the distance evaluation of learners as the goal of SPOC and SPOC+ is to allow 100% distance education.

Our practical contribution is the adaptation of the MIRTO project for use on mobile artefacts, while at the same time allowing it to be scalable to adapt easier to new tools and learning solutions. An apparent limitation of our platform is that we have developed SPOC+ only for French language learning.

We have hoped to be able to test our solution with a group of 25 learners from a non-French speaking country with the AI tools, so we present the SPOC+ platform in a real test environment with a satisfaction study of all those using the platform.

The convergence of the redaction of our article concerning the role of AI on SPOC+ and the international pandemic of Coronavirus disease 2019 (COVID-19), led us to make our platform perfect as quickly as possible. It is obvious that in this period, the usefulness of 100% distance learning platforms is becoming more and more

clear. For example, several universities and institutions around the world are turning to the use of new online platforms such as Boston University[40] which wants to promote its next semester through online education. The use of this platform will allow the language learner and a large number of people who are unfortunately far from the educational path, to have access to teaching and learning, which is a fundamental human right [18].

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