E-inclusion modeling for blended e-learning course

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Abstract

This study addresses the e-inclusion problem that relates to the inclusion of as many individuals as possib
enjoy benefits of information and communication technology. Despite the fact that European Union accepte
inclusion declaration in 2006 which aims to reduce disparities that exist among individuals and to improve the l
of e-skills among people, nowadays e-inclusion problem still exists. Therefore it is necessary to find out
approach to promote e-inclusion in society. We propose a more nuanced design approach that takes into acc
student's satisfaction with e-learning environment and e-materials, student's ability to learn, instructor willingne
share knowledge and others factors. Moreover we believe that e-inclusion means not only high level of digital s
but also the usage of these digital skills to benefit from technologies. To obtain predictors for algorithms we d
inclusion data domain study based on knowledge management theory. The aim of proposed work is to prese
inclusion theoretical model which is based on integration of several algorithms as multiply linear regression
cluster analysis. These algorithms were calculated based on statistical data obtained on evaluating a group of
hundred blended e-course learners. In this paper we propose architecture designed to predict e-inclusion degr
student based on machine learning and intelligent agent approach. We identified two main processes in th
inclusion prediction system. The first process consists of agent learning activities. Intelligent agents learn the
appropriate algorithm to predict e-inclusion degree of student based on linear regression or cluster analysis.
second process includes activities to predict e-inclusion degree of student. This process covers analysis o
inclusion risks and communication between student and instructor also. Proposed e-inclusion model consists of
diagram, use cases diagrams and main algorithms of the system. As the result of the e-inclusion model is predi
of e-inclusion degree of person as well as e-inclusion risk factors for person, for instance inappropriate e-lear
materials or no interest to learn, or dissatisfaction with e-learning environment, or others factors.

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1. Introduction

This study aims to address the e-inclusion problem that was outlined in the EU Digital Agenda 2020 that re
to the inclusion of as many individuals as possible to enjoy the benefits of information and communic
technology (ICT)[1]. Nowadays the digital divide goes beyond the issue of access to technology. Focus has sl
from access to ICT to digital skills and the meaningful use of ICT[2]. There is a gap between knowing to d
practical usage of digital skills. Learning a new skill and using it are two separate steps[3]. The 2010 OECD r
stated that a second digital divide separates those with the competencies and skills that benefits from compute
from those without these advantages[4].

Several studies indicate that there is a need to look for factors that characterize the e-included individ
Therefore, it is necessary to identify the factors that influence e-inclusion process so that individuals learn
technologies and use them meaningfully. There are currently no comprehensive methods to monitor meaningfu
of digital skills in order to prevent the ICT usage gap.

There is no special technology for e-inclusion prediction. Usually systems predict whether students drop o
complete course. Machine learning approach is used for student achievement and other event prediction. Ma
learning and agent technologies are integrated with a particular interest on applying agent-based solutio
supervised learning[6].

This study contributes to research of the meaningful ICT use in blended learning context. In this pape
propose a new system architecture designed to predict e-inclusion degree of student based on machine learnin
intelligent agent approach.

The paper is organized as follows. In the section 2 technologies and methods of prediction are described.
section 3 introduces e-inclusion model design. In the section 4 e-inclusion prediction algorithms are presented
section 5 is conclusion part.

2. Technologies and methods of the e-inclusion prediction

2.1. Review of literature

According to Strickland[7] predictive analytics is an area of data science that deals with extracting inform
from data and using it to predict trends and behavior patterns. A predictive model is a statistical model or ma
learning model used to predict future behavior based on past behavior. Machine learning approach is used into
oriented systems to train agents. In the literature machine learning and agent oriented system development m
has following steps: agent selection, problem domain analysis and data selection and pre-processing, selecti
machine learning method and algorithm, model evaluation and implementation with prediction function[8].

Machine learning-based system has two main processes: (1) system training process and (2) the predi
process (Fig.1). Each of these two phases is subdivided into several steps and presented in the Figure 1.

Machine learning process begins with analysis of problem domain and data selection[9]. More appropi
selection of data is possible after deep problem domain analysis.

Data pre-processing aims to create a sample database containing both the training and test data for the model

Next step is selection of algorithm and method for prediction. Training data are transferred to the tra
algorithm. At this stage a predictive model is build. In the literature this stage is known as creation of the know
base[11]. It should be noted that no machine learning method or algorithm is clearly better than another, bu
machine learning method should be assessed with test data sets for more precise results. Data analysis professi