





processes and operations, [7]. This awakened the academic community to a new and promising field of study, called of learning analytics. Many studies were developed allowing several tools to emerge that are been applied in education. These tools conducted to clarify benefices and challenges of learning analytics in education.

This section will present some learning analytics tools that are been application in education, namely RapidMiner, Waikato Environment for Knowledge Analysis (Weka) and Tableau.

#### A. RapidMiner

The software RapidMiner, formerly known as YALE (Yet Another Learning Environment), was developed in 2001 by Ralf Klinkenberg, Ingo Mierswa and Simon Fischer in the Artificial Intelligence Unit of the Technical University of Dortmund<sup>1</sup>[8].

The Rapid Miner tool [9] is a tool that provides several data mining and other functionalities (ETL, reporting, etc.). This tool compatible with Windows, Unix and Linux. The data source systems available in Rapid Miner range from excel files, through text files, to the most popular DBMS (e.g., Microsoft SQL Server, Oracle, MySQL, Sybase, etc).

This tool has some characteristic features, of which we highlight [10]: Data Mining Tools; Statistical analysis; Machine learning; Data extraction; connected data management.

This software uses a client/server model with the server offered on-site or in public or private cloud infrastructures.<sup>2</sup>

#### B. Weka

The Weka software package (Waikato Environment for Knowledge Analysis) started to be written in 1993, using Java, at the University of Waikato, New Zealand and was later acquired by a company in late 2006. Weka is licensed under General Public License therefore it is possible to study and change the respective source code [11].

The Weka is one of the most popular data mining tools. Although well known, it is typically used only for teaching purposes (in data mining courses) or in small experiments. However, the tool provides a very powerful and flexible Java API that allows its integration with any type of Java system. Weka has consolidated itself as the most used data mining tool in the academic environment. It is applied not only in scientific research, but also for didactics [12].

The Weka offers some features like [12] [13]:

- ⇒ **x Prediction:** Weka provides algorithms that allow the computer to learn, that is, through existing patterns in the data at the time of the analysis, the computer can predict possible future events
- ⇒ **x Classification and regression:** the tool implements classification and regression algorithms, these, like the forecasting algorithms, aim to predict future occurrences of data through current standards

- ⇒ **x Clustering:** by applying clustering algorithms, users are able to identify data that share similar trends and patterns.

#### C. Tableau

Tableau Software is an American interactive data visualization software company<sup>3</sup> founded in January 2003 by Christian Chabot, Pat Hanrahan and Chris Stolte, in Mountain View, California. The company is currently headquartered in Seattle, Washington, United States<sup>4</sup> focused on business intelligence<sup>5</sup>. On August 1, 2019, Salesforce acquired Tableau<sup>6</sup>. The Tableau Tool is a powerful data visualization tool used in business intelligence and data analysis. [14].

Tableau products query relational databases, online analytical processing cubes, cloud databases, and spreadsheets to generate graph-type data visualizations. The products can also extract, store, and retrieve data from an in-memory data engine.

The visualization provided by Tableau has completely enhanced the ability to gain more knowledge about the data we are working on and can be used to provide more accurate predictions. Tableau also has functionality for building rich and interactive dashboards, capable of displaying dynamic real-time visualizations to end users. However, Tableau's functionality is limited to this; it does not support predictive analytics or relational data mining.

#### D. Comparative Analysis

Making now a comparative analysis between that 3 software's, it will help us to choose which tool to use and how it is to be used in our project. All the tools presented were studied. These were subject to comparison and critical analysis, in the end one of them will be chosen for a practical applicability problem. The chosen tool was then used to create a practical proof of concept, aiming to show the quality of the solution produced by this type of tool [12].

The criteria chosen to carry out this analysis are presented in the table 1 and were based on the following assumptions:

- 1. Usability** - This feature determines the usability of each tool. This describes which user interface is comparatively easier to use.
- 2. Speed** - is an important distinguishing factor among different data mining tools. It helps to understand how system configuration impacts the working of a particular data mining tool.
- 3. Visualization** - Visualization is the most important feature of a data mining tool.
- 4. Algorithms supported** - This feature classifies data mining tools based on the algorithm implementation supported by them and the descriptor selection choice available.

<sup>3</sup>A Dead-Simple Tool That Lets Anyone Create Interactive Maps

<sup>4</sup>Tableau Software Helping Data Become More Visual

<sup>5</sup>"Tableau Business Intelligence". Tableau Software. Retrieved 2020-02-11.

<sup>6</sup>"Salesforce Completes Acquisition of Tableau". tableau.com. Retrieved 2020-02-20.

<sup>1</sup>Guido Deutsch, "RapidMiner from Rapid-I at CeBIT 2010," Data Mining Blog, March 18, 2010.

<sup>2</sup>David Norris, "RapidMiner - a potential game changer," IT-Director.com, November 22, 2013.





