Assignment 2: The Raven Test

In Search for Group Differences

Data Mining, University of Aveiro
2019

Filipe Pires, 85122
DETI, MSc. Informatics Engineering

João Alegria, 85048
DETI, MSc. Informatics Engineering

Abstract—**The search for trustworthy methodologies of determining a measurable intelligence index has been a quest of our brightest minds for decades. Raven matrices tests have proved to have widespread practical use as a measure of intelligence. They are a source of data for many studies on the general population as they seem promising tools for contexts such as psychometric tests or clinical assessment.**

In one study on the application of these matrices to groups of students from different backgrounds, questions emerged regarding the possibility of clear differences between Multimedia and Informatics students. In this paper we present the statistical analysis applied to the tests results with the help of ML classification techniques in search for determining whether any of the two groups showed significant advantages over the other.

Index Terms—**Raven Matrices, Psychometric Tests, Intelligence Measure, Support Vector Machine, Multi-Layer Perceptron, Decision Tree, K-Nearest-Neighbors**

I. INTRODUCTION

Raven's Advanced Progressive Matrices (RAPM) is a non-verbal group test typically present in educational or clinical settings, as it is used in measuring abstract reasoning and regarded as a non-verbal estimate of fluid intelligence [1]. Examples of related test are Naglieri Nonverbal Ability or Spacial Ability Tests. Their practical use is very extended, and applicable to both adults and children. Nevertheless, studies that resort to them usually focus on populations containing groups with specific differences in order to draw conclusions from these differences. Examples of these studies are on different military sections, or different mental disabilities.

In the study whose collected data was used for our analysis [2], the aim was to compare university students from different fields in terms of learning styles effectiveness. Several tests such as Kolb and VAK or Hermann dominances allow to distinguish some learning styles like: Accommodator, Assimilator, Auditory, Convergent, Divergent, Kinesthetic and Visual. But beyond this, the researchers also applied the RAPM tests to reach more robust conclusions, and combine all results in a meaningful way. In this paper we focus only on the data related to the second set of tests.

The population that conducted the Raven tests was a group of 45 university students, 21 of Design and Multimedia and 24 of Informatics Engineering. 48 problems were presented to the distinct populations and were divided into two phases: during the first 12, the participant would receive a feedback about his/her answer; for the remaining 36 no feedback was given. During the test execution electroencephalographic (EEG) signals were registered while the participants performed the tasks, using Enobio 8 EEG recording headset and 8 channels: *F3, F4, T7, C3, Cz, C4, T8* and *Pz*.

Our aim is to determine, solely from this estimated measurement of intelligence, whether both groups hold characteristics significantly different from each other by building classification algorithms that interpret the EEG signals and other time-related metrics as features and attempt to predict which class of students a new entry belongs to. We also intend to compare our conclusions with those obtained by the original researchers.

II. DATASET & FEATURE EXTRACTION

Lorem ipsum ...

III. DATA QUALITY & NORMALIZATION

Lorem ipsum ...

IV. CLASSIFIERS

Lorem ipsum ...

V. PARAMETERS VARIATION

Lorem ipsum ...

VI. RESULTS DISCUSSION

Lorem ipsum ...

VII. CONCLUSIONS & FUTURE WORK

Lorem ipsum ...

REFERENCES

[1] Warren B. Bilker et al., "Development of Abbreviated Nine-item Forms of the Raven's Standard Progressive Matrices Test", https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4410094, accessed in December 2019.

[2] Felisa M. Córdova et al., "Identifying Problem Solving Strategies for Learning Styles in Engineering Students Subjected to Intelligence Test and EEG Monitoring", https://www.sciencedirect.com/science/article/pii/S1877050915014787, Procedia Computer Science 55 (2015), accessed in December 2019.

[3] A. Tomé, "Data Mining Assignment", https://elearning.ua.pt/pluginfile.php/1496406/mod_resource/content/3/ED_HCT_Raven.pdf, accessed in December 2019.