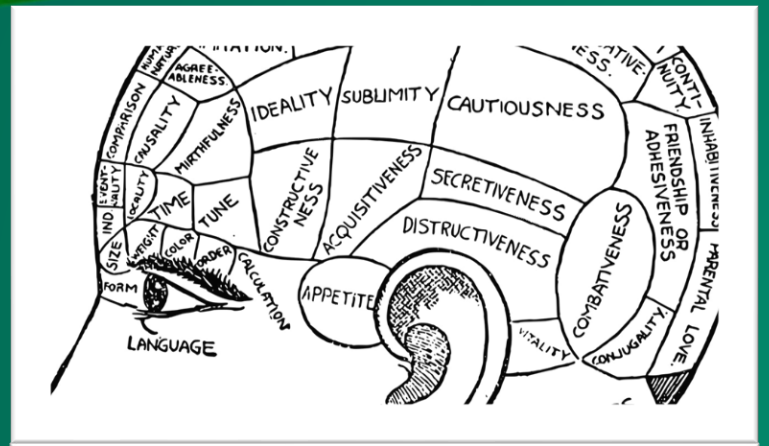
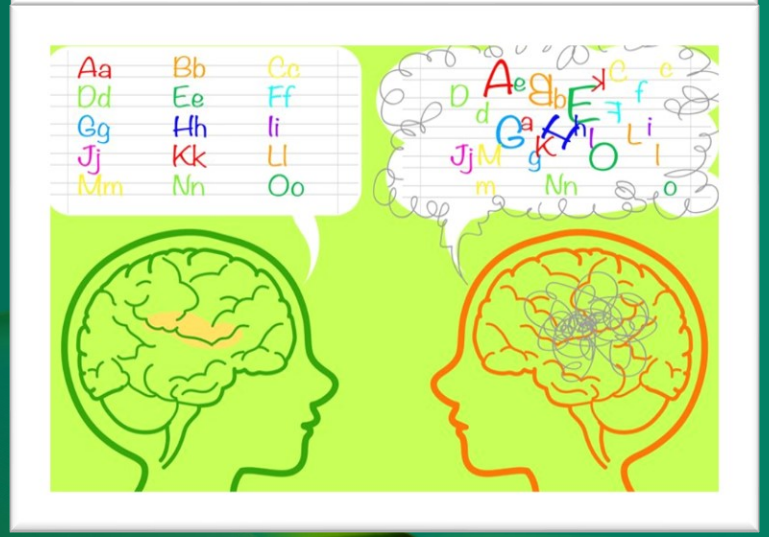
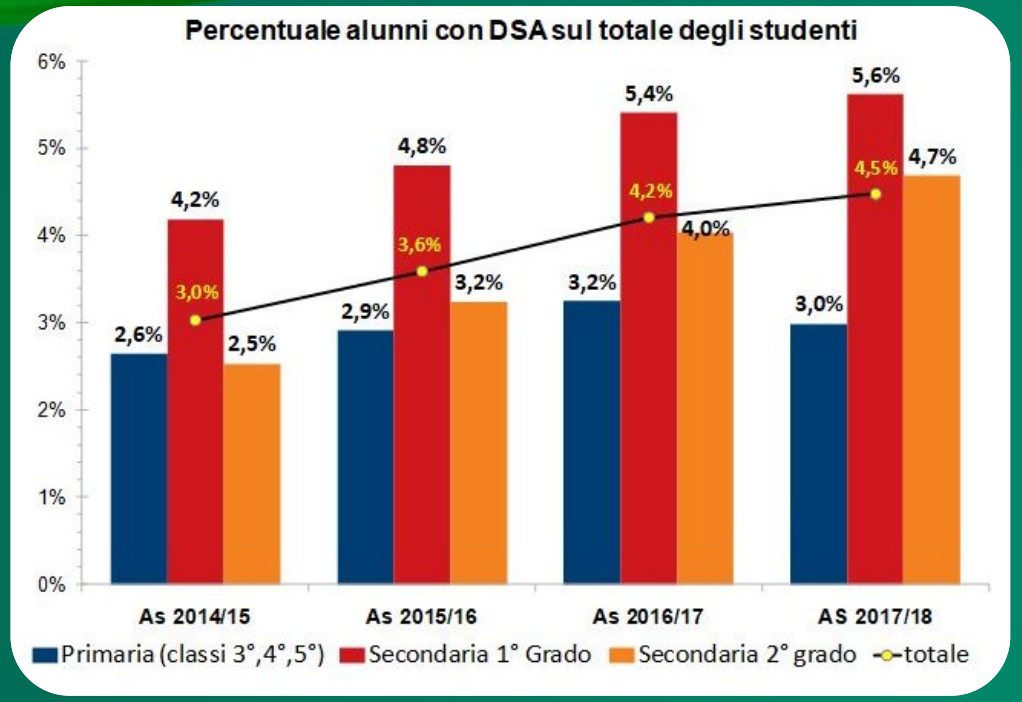
“Using artificial intelligence to support university students with dyslexia during their academic career”





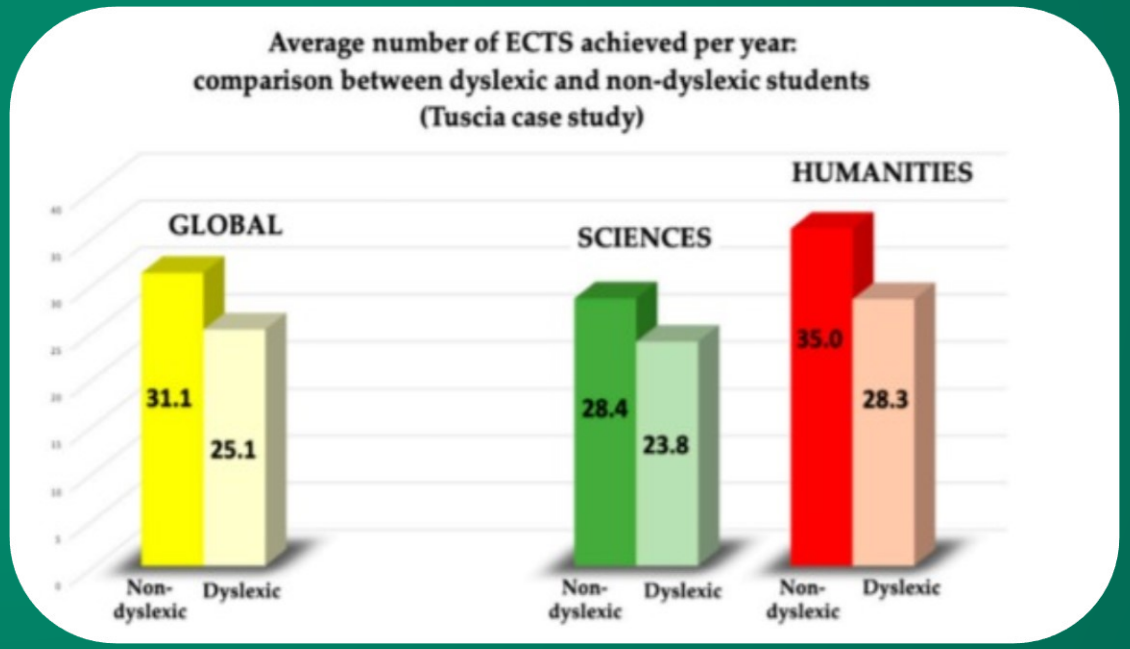
WHAT DYSLEXIA IS ?

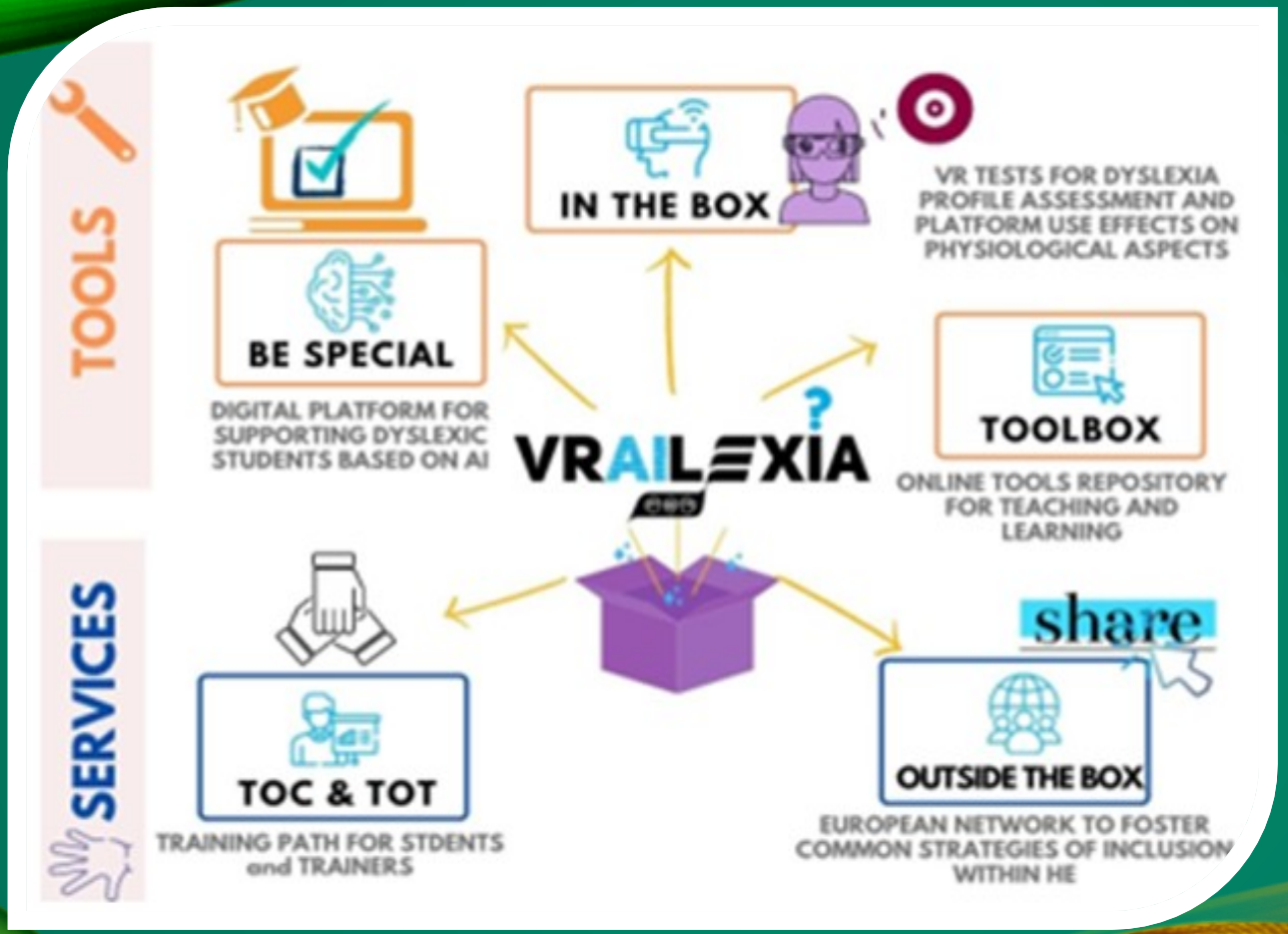
GAP BETWEEN THE SUPPORT METHODOLOGIES PROVIDED



- *Primary school*
- *Secondary school*
- *University students*

Cfu gap




TOOLS
SERVICES
IN THE BOX
VR TESTS FOR DYSLEXIA PROFILE ASSESSMENT AND PLATFORM USE EFFECTS ON PHYSIOLOGICAL ASPECTS
BE SPECIAL
DIGITAL PLATFORM FOR SUPPORTING DYSLEXIC STUDENTS BASED ON AI
VRAILEXIA
TOOLBOX
ONLINE TOOLS REPOSITORY FOR TEACHING AND LEARNING
TOC & TOT
TRAINING PATH FOR STDENTS and TRAINERS
share
OUTSIDE THE BOX
EUROPEAN NETWORK TO FOSTER COMMON STRATEGIES OF INCLUSION WITHIN HE

VRAILEXIA

BESPECIAL PLATFORM

using artificial intelligence and virtual reality allows evaluating the condition of students with dyslexia.

SURVEY CONDUCTED IN ORDER TO COLLECT DATA USEFUL FOR TRAINING THE PREDICTOR

3 types of questions were asked:

1. *Demographic questions (year of birth, sex, age, type of school attended, etc.).*

2. *Questions about the history of each person's dyslexia (when the diagnosis was received, if they have other disorders including anorthography , dyscalculia, etc.).*

3. *Questions focused on problems and needs generally encountered by the students.*

INPUT: DYSLEXIA ISSUES

AI ALGORITMS

Tuning

Training

testing

OUTPUT: TOOLS AND STRATEGIES

ISSUES

I1. Difficulty in reading
i2. Difficulty in understanding the text
I3. Difficulty in understanding words difficult or uncommon
I4. Difficulty understanding the lessons
I5. Difficulty concentrating during it study
I6. Difficulty of attention during lessons in presence
I7. Difficulty paying attention during lessons online
I8. Difficulty memorizing concepts just studied
I9. Difficulty remembering the concepts studied during the exam
I10. Difficulty in organizing time e of study
I11. Difficulty taking notes
I12. Difficulty of construction in the short time a arrangement to prepare a game / question / exam

TOOLS

T1. Audio book with human voice
T2. Audio book with robotic voice
T3. Words written in different colors
T4. Using the EasyReading font
T5. Use of a smart pen or a tablet to take notes and record the voice
T6. Clearer layout of the study material
T7. Have your text keywords highlighted
T8. Ready-made concept maps
T9. Ready-made schemes
T10. Ready-made summaries
T11. E-books (digital books)
T12. Digital tutor (like Siri) to ask for unclear things
T13. Images that help you understand and remember the meaning of single difficult words
T14. Images that help memorize and remember a concept
T15. Audio recording of the lessons
T16. Video lessons
T17. Have the ability to integrate study material with internet research

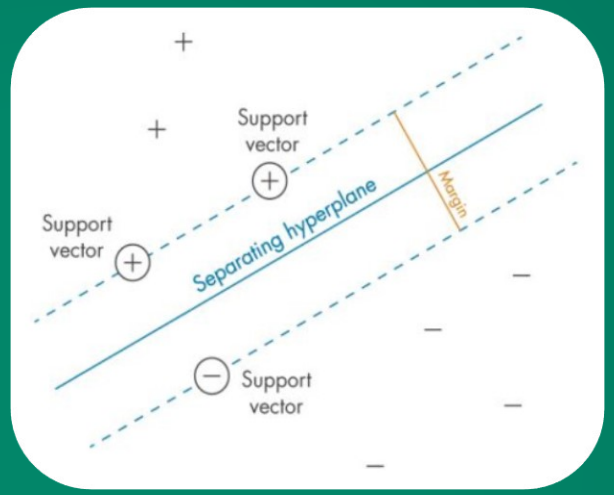
STRATEGIES

S1. A person who reads to me
S2. Maps made by me
S3. Patterns made by me
S4. Summaries made by me
S5. Repeat the material studied
S6. Mark your keywords
S7. Underline with different colors
S8. Have a study group
S9. Having a tutor
S10. Create an association of students with dyslexia to exchange information and resources
S11. Attend face-to-face lessons
S12. Have online lessons available
S13. Take breaks during lessons
S14. Have the slides of the lessons available
S15. Record the lessons
S16. Take notes
S17. Have the lesson plan in advance
S18. Having the possibility to divide an exam or a task / question into several parts
S19. Have written exams or tests only
S20. Have only oral exams or checks
S21. Carry out exams or homework questions in the presence of the teacher only
S22. Have an online database with notes, diagrams, summaries etc. available, made by other students

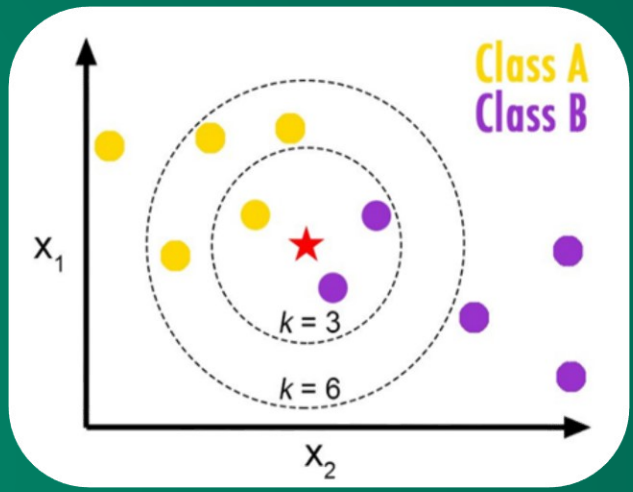
MACHINE LEARNING ALGORITHMS USED

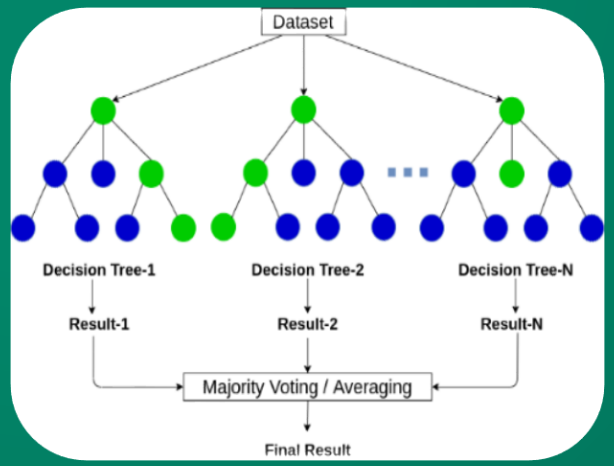
tuning used:
for all algorithms binary classification output was used, and threshold from 1 to 4.
Logistic regression: numerical input.
Random forest: both numeric and binary classification input, also used 50 trees and 20 folds.
KNN: both binary Classification and numeric inputs are used, with values of k = 1,3,5,7,21.
SVM type of input as knn, with linear, polynomial and circular kernel.

Support vector machine

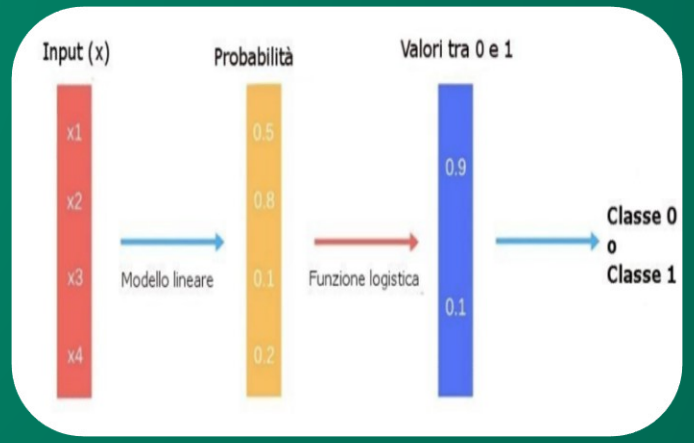


K-Nearest Neighbor

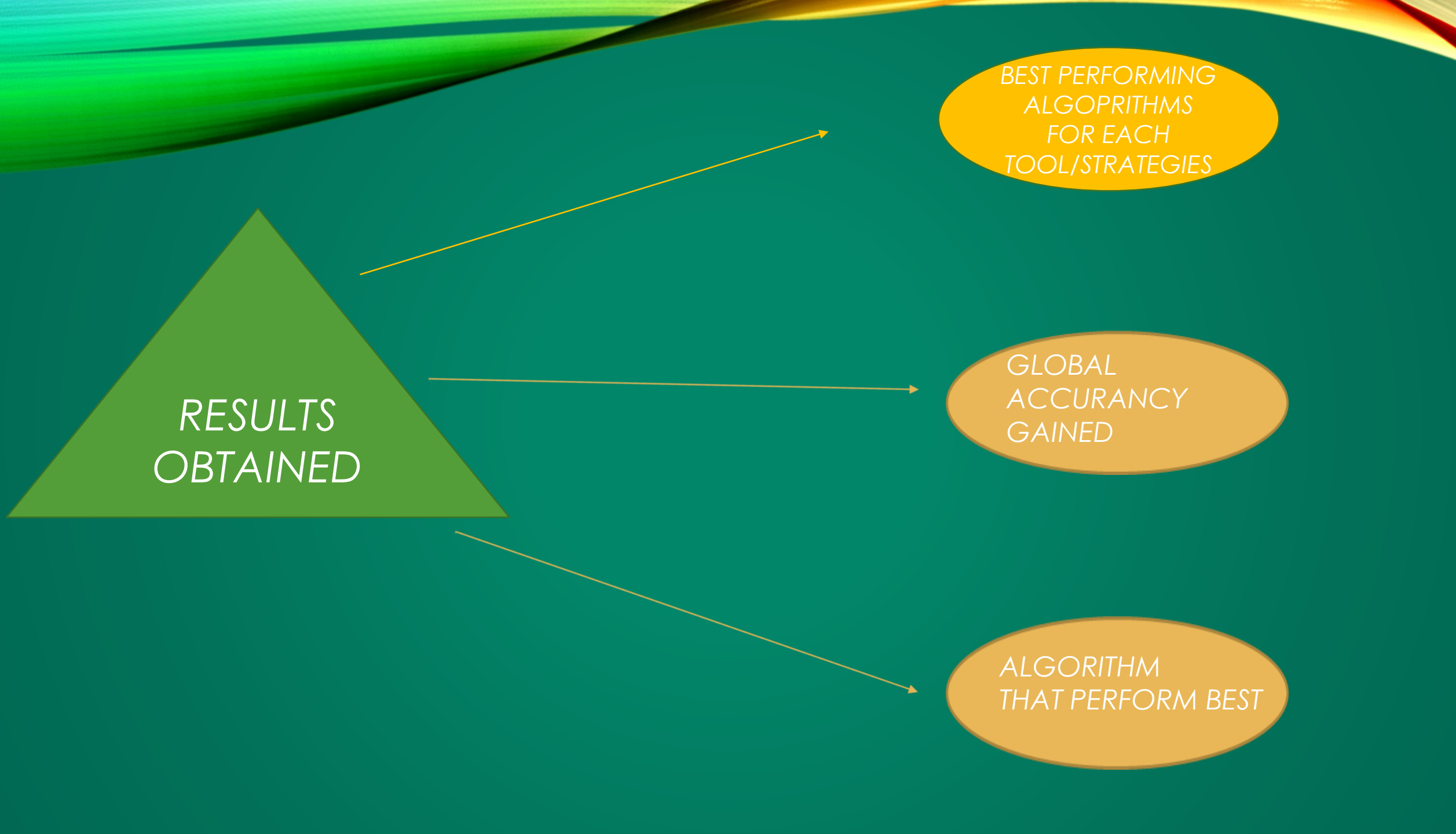




Random Forest



Logistic Regression


RESULTS OBTAINED
BEST PERFORMING ALGOPRITHMS FOR EACH TOOL/STRATEGIES
GLOBAL ACCURANCY GAINED
ALGORITHM THAT PERFORM BEST

BEST PERFORMING ALGORITHM: TOOLS

T1	SVM - Linear Kernel Input = BINARY CLASSIFICATION , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.76
T2	RANDOM FOREST input = SCORE , Output = BINARY CLASSIFICATION (Thr = 4)	Accuracy=0.94
T3	K-Nearest Neighbours K=21 Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.914
T4	SVM - Linear Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 4)	Accuracy=0.86
T5	SVM - Linear Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.87
T6	SVM - Linear Kernel Input = BINARY CLASSIFICATION , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.96
T7	RANDOM FOREST input = SCORE , Output = BINARY CLASSIFICATION (Thr = 4)	Accuracy=0.98
T8	K-Nearest Neighbours K=21 Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.93
T9	SVM - Linear Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 4)	Accuracy=0.93

T10	SVM - Linear Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.95
T11	SVM - Gaussian (circular) Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.78
T12	SVM - Gaussian (circular) Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.80
T13	K-Nearest Neighbours K=7 Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.95
T14	SVM - Gaussian (circular) Kernel Input = BINARY CLASSIFICATION Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.97
T15	SVM - Linear Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.94
T16	SVM - Gaussian (circular) Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.93
T17	K-Nearest Neighbours K=7 Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.94

BEST PERFORMING ALGORITHM: STRATEGIES

S1	SVM - Gaussian (circular) Kernel Input = NUMERIC ,Output = BINARY CLASSIFICATION (Thr = 4)	Accuracy=0.79
S2	SVM - Linear Kernel Input = BINARY CLASSIFICATION , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.99
S3	K-Nearest Neighbours K=7 Input = NUMERIC, Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.98
S4	RANDOM FOREST (50 Trees) Input = SCORE , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.97
S5	SVM - Gaussian (circular) Kernel Input = BINARY CLASSIFICATION , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.99
S6	RANDOM FOREST (50 Trees) Input = SCORE , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.98
S7	K-Nearest Neighbours K=7 Input = BINARY CLASSIFICATION, Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.94
S8	K-Nearest Neighbors K=21 Input = NUMERIC, Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.90
S9	SVM - Gaussian (circular) Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.89
S10	SVM - Gaussian (circular) Kernel Input = BINARY CLASSIFICATION , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.90
S11	SVM - Gaussian (circular) Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.95
S12	SVM ,Gaussian (circular) Kernel Input = NUMERIC Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.97
S13	RANDOM FOREST (50 Trees) Input = SCORE , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.99
S14	k-Nearest Neighbors K=7 Input = NUMERIC, Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.99
S15	K-Nearest Neighbors K=7 Input = BINARY CLASSIFICATION, Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.97
S16	SVM - Gaussian (circular) Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.97
S17	K-Nearest Neighbors K=7 Input = NUMERIC, Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.95
S18	K-Nearest Neighbors K=7 Input = BINARY CLASSIFICATION, Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.97
S19	SVM - Gaussian (circular) Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.87
S20	KNN-Input and Output = BINARY CLASSIFICATION k=21 (Thr = 1)	Accuracy=0.97
S21	SVM - Gaussian (circular) Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.87
S22	SVM - Gaussian (circular) Kernel Input = NUMERIC , Output = BINARY CLASSIFICATION (Thr = 1)	Accuracy=0.95

ACCURANCY GAINED

AVERAGE: 0,941
STANDARD DEV 0,047

DISCARDING VALUES UNDER 85%

AVERAGE: 0,95
STANDARD DEV 0,04

4/39 UNPREDICTABLE Supporting METHOLOGIES

ALGORITHM THAT PERFORMS BEST → SVM

as an additional outcome, the best algorithm was identified: It is the the one containing the best average accuracy

CONCLUSION

- *Built the predictor*
- *Algorithm that performs best*
- ✓ *more than 9 out of 10 subjects will have an accurate prediction.*

'there is real progress only when advantages of a new technology become so for everyone'.

-Henry Ford

FURTHER DEVELOPMENT: A STUDENT-SPECIFIC PREDICTOR

- *Others languages*
- *Others disorders*

From category specific to student specific thanks to the feedback form(close loop).

“A year spent in artificial intelligence is enough to believe in God”.
-Alan Perlis

THANKS !