




Review and discussion of project-related approach

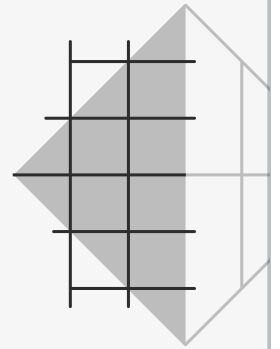
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Reviewed papers:

- Studying the relationship between anxiety and school achievement: evidence from PISA data
- What Should We Understand from PISA 2022 Results?
- Stacking: An ensemble learning approach to predict student performance in PISA 2022



Studying the relationship between anxiety and school achievement: evidence from PISA data[1]

- Subject
- Approach
- Results

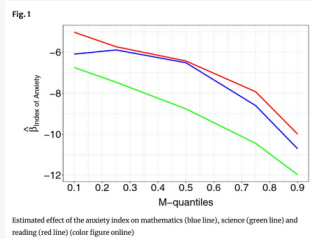


Table 1 Descriptive statistics of the outcome variable and covariates

Variable	Min.	1st Q.	Median	Mean	3rd Q.	Max.
SCIENCE	120.42	425.73	493.28	489.48	544.69	803.30
MATHEMATICS	140.80	432.16	498.19	496.39	560.72	822.64
READING	168.34	435.94	500.51	496.14	560.97	773.59
ESCS	-2.99	-0.70	-0.04	-0.02	0.66	3.56
Anxiety index	-2.51	-0.08	0.52	0.48	1.05	2.55
Female				0.51		
Immigrant				0.07		
Grade repetition				0.13		
Lack of punctuality				0.35		
South Italy				0.44		
Lycium				0.42		
Mean gender				0.50		
Mean immigrant status				0.09		
Mean Grade repetition				0.16		
Mean Lack of punctuality				0.36		
Mean ESCS				-0.20		
Number of units	7142					
Number of clusters	283					

What Should We Understand from PISA 2022 Results?[2]

- **Subject** – Evaluate the factors that improve student's performance
- **Approach** – Split data per country
- **Results** – Socio-economic status, technology and teacher support

Reading score				Math score				Science score			
Country		2018	2022	Country		2018	2022	Country		2018	2022
Above the OECD average				Above the OECD average				Above the OECD average			
England	543	-1	542	China	438	-19	419	Sweden	561	10	571
Denmark	516	-1	515	China (Chongqing)	436	-38	398	Japan	547	17	564
Japan	516	13	529	China (Shanghai)	430	3	433	China	543	9	552
China	515	-1	514	United Arab Emirates	429	21	450	United Kingdom	537	22	559
China (Beijing)	511	-12	499	Finland	428	1	429	Finland	526	9	535
China (Chongqing)	510	-19	491	United Kingdom	417	-14	403	United Kingdom	515	-3	512
Canada	507	-13	494	United Arab Emirates	415	-5	410	United Kingdom	504	-4	500
United States	506	-1	505	Costa Rica	415	-11	404	United Kingdom	500	-5	495
New Zealand	501	-26	475	Poland	411	-13	400	United Kingdom	499	-3	496
Hong Kong (China)	500	-24	476	Poland	409	-8	401	United Kingdom	498	-1	497
Australia	498	-1	497	Poland	408	-8	400	United Kingdom	494	-6	488
United Kingdom	494	-16	478	Poland	405	-12	393	United Kingdom	492	-11	481
United States	493	-36	457	Poland	404	-16	388	United Kingdom	491	-1	490
Germany	489	-12	477	Poland	403	-1	402	United Kingdom	489	-15	474
France	489	-23	466	Poland	402	-1	401	United Kingdom	488	-1	487
Czech Republic	488	-12	476	Poland	401	-1	400	United Kingdom	487	-6	481
Sweden	487	-19	468	Poland	400	-1	399	United Kingdom	486	-5	481
Switzerland	483	-15	468	Poland	399	-1	398	United Kingdom	485	-1	484
Italy	482	-16	466	Poland	398	-1	397	United Kingdom	484	-7	477
Austria	480	-4	476	Poland	397	-1	396	United Kingdom	483	-10	473
Germany	479	-14	465	Poland	396	-1	395	United Kingdom	482	-11	471
Belgium	477	-15	462	Poland	395	-1	394	United Kingdom	481	-1	480
Portugal	477	-23	454	Poland	394	-25	369	United Kingdom	480	-15	465
Norway	475	-1	474	Poland	393	-1	392	United Kingdom	479	-1	478
Croatia	475	-1	474	Poland	392	-1	391	United Kingdom	478	-1	477
Latvia	474	-4	470	Poland	391	-1	390	United Kingdom	477	-1	476
Spain	474	N.A.	474	Poland	390	-1	389	United Kingdom	476	-1	475
France	474	-19	455	Poland	389	-1	388	United Kingdom	475	-1	474
Sweden	474	-19	455	Poland	388	-1	387	United Kingdom	474	-1	473
Italy	473	-1	472	Poland	387	-1	386	United Kingdom	473	-1	472
Hungary	473	-1	472	Poland	386	-1	385	United Kingdom	472	-1	471
United States	472	-1	471	Poland	385	-1	384	United Kingdom	471	-1	470
United States	469	-27	442	Poland	384	-1	383	United Kingdom	470	-1	469
New Zealand	462	N.A.	462	Poland	383	-1	382	United Kingdom	469	-1	468
Netherlands	459	-26	433	Poland	382	-1	381	United Kingdom	468	-1	467
Turkey	456	-19	437	Poland	381	-1	380	United Kingdom	467	-1	466
Chile	448	-4	444	Poland	380	-1	379	United Kingdom	466	-1	465
Czech Republic	447	-11	436	Poland	379	-1	378	United Kingdom	465	-1	464
Malta	445	-3	442	Poland	378	-1	377	United Kingdom	464	-1	463
Serbia	440	-1	439	Poland	377	-1	376	United Kingdom	463	-1	462

- Objective

- Pisa 2022

The main purpose of PISA is to measure students' ability to use the knowledge and skills learnt at school in daily life

consists in multiple questions, to test the skills and knowledge of 15-year-old students in mathematics, reading and science

- Covid

- Approach

- Results:

Socio-economic

Technology and motivation

Teacher Support

Stacking: An ensemble learning approach to predict student performance in PISA 2022[3]


- **Subject:** research stacking ML algorithms to predict student performance in large-scale assessments based on a wide range of predictors (Dataset: Pisa 2022 Student)
- **Approach:**
 - Stacking:
 - level 0, n models generate distinct predictions
 - models: DTs, NN, SVMs and kNNs
 - level 1, combine predictions
 - Ridge regression
 - Boosting: *XGBoost*, *HGB*, and *LightGBM*
 - Blending: similar to stacking but excludes a portion of the training set
- **Results:** The algorithm performance was measured using *MAPE*, *MAE*, *MSE* and *RMSE*
 - Stacking: Significant lowest metric score
 - Better performance, stable and accurate predictions

Subject		Mathematics	Reading	Science
Metrics	Algorithm	Number (%) of the countries	Number (%) of the countries	Number (%) of the countries
Mean MAPE	Stacking	72 (90.00)	64 (80.00)	65 (81.25)
	Blending	4 (5.00)	4 (5.00)	6 (7.50)
	XGBoost	-	1 (1.25)	1 (1.25)
	LightGBM	2 (2.50)	6 (7.50)	3 (3.75)
	Blending & Stacking	-	2 (2.50)	2 (2.50)
	Stacking & XGBoost	-	-	2 (2.50)
	Blending & LightGBM	-	-	1 (1.25)
	LightGBM & XGBoost	2 (2.50)	1 (1.25)	-
	HGB & LightGBM	-	1 (1.25)	-
	XGBoost & HGB & LightGBM	-	1 (1.25)	-
Mean MAE	Stacking	74 (92.50)	69 (86.25)	71 (88.75)
	Blending	1 (1.25)	1 (1.25)	2 (2.50)
	XGBoost	1 (1.25)	2 (2.50)	3 (3.75)
	HGB	1 (1.25)	1 (1.25)	-
	LightGBM	3 (3.75)	7 (8.75)	4 (5.00)
Mean MSE	Stacking	75 (93.75)	70 (87.50)	71 (88.75)
	Blending	1 (1.25)	1 (1.25)	2 (2.50)
	XGBoost	-	3 (3.75)	1 (1.25)
	HGB	-	1 (1.25)	-
	LightGBM	4 (5.00)	5 (6.25)	6 (7.50)

The Number (%) of the countries exhibiting the lowest error values generated by each algorithm for all subjects [3]



Camparison/Conclusion

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- The Anxiety Index increases with the increase in perfectionist characteristics and performance goals, and it negatively impacts students' performance
 - Socio-economic status, digital technologies and teacher support can impact in students performance.
 - **Stacking** showed significantly better scores than **boosting** and **blending**

As we wrap up our discussion, let's highlight a few key takeaways:

First, we've observed that the Anxiety Index has a direct correlation with perfectionist traits and performance goals. [Pause for emphasis] This increase in anxiety can adversely affect students' overall performance.

Next, let's consider the impact of external factors. Socio-economic status, access to digital technologies, and teacher support can significantly influence student outcomes. [Pause] These elements are crucial in understanding the broader context of student performance in assessments like PISA.

Finally, our findings show that the stacking method outperformed both boosting and blending techniques in terms of predictive accuracy. [Emphasize this point] This suggests that stacking could be a valuable approach in educational data analysis.

Thank you for your attention, and I look forward to our next discussion.

References

- [1] D'Agostino, A., Schirripa Spagnolo, F. & Salvati, N. Studying the relationship between anxiety and school achievement: evidence from PISA data. *Stat Methods Appl* 31, 1–20 (2022). <https://doi.org/10.1007/s10260-021-00563-9>
- [2] İdil, Ş., Gülen, S., & Dönmez, İ. (2024). What Should We Understand from PISA 2022 Results?. *Journal of STEAM Education*, 7(1), 1–9. <https://doi.org/10.55290/steam.1415261>
- [3] Öz, E., Bulut, O., Cellat, Z.F. et al. Stacking: An ensemble learning approach to predict student performance in PISA 2022. *Educ Inf Technol* (2024). <https://doi.org/10.1007/s10639-024-13110-2>

Thank you!

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