

Use of Item Response Theory (IRT) algorithm to assess the progression of undergraduate students

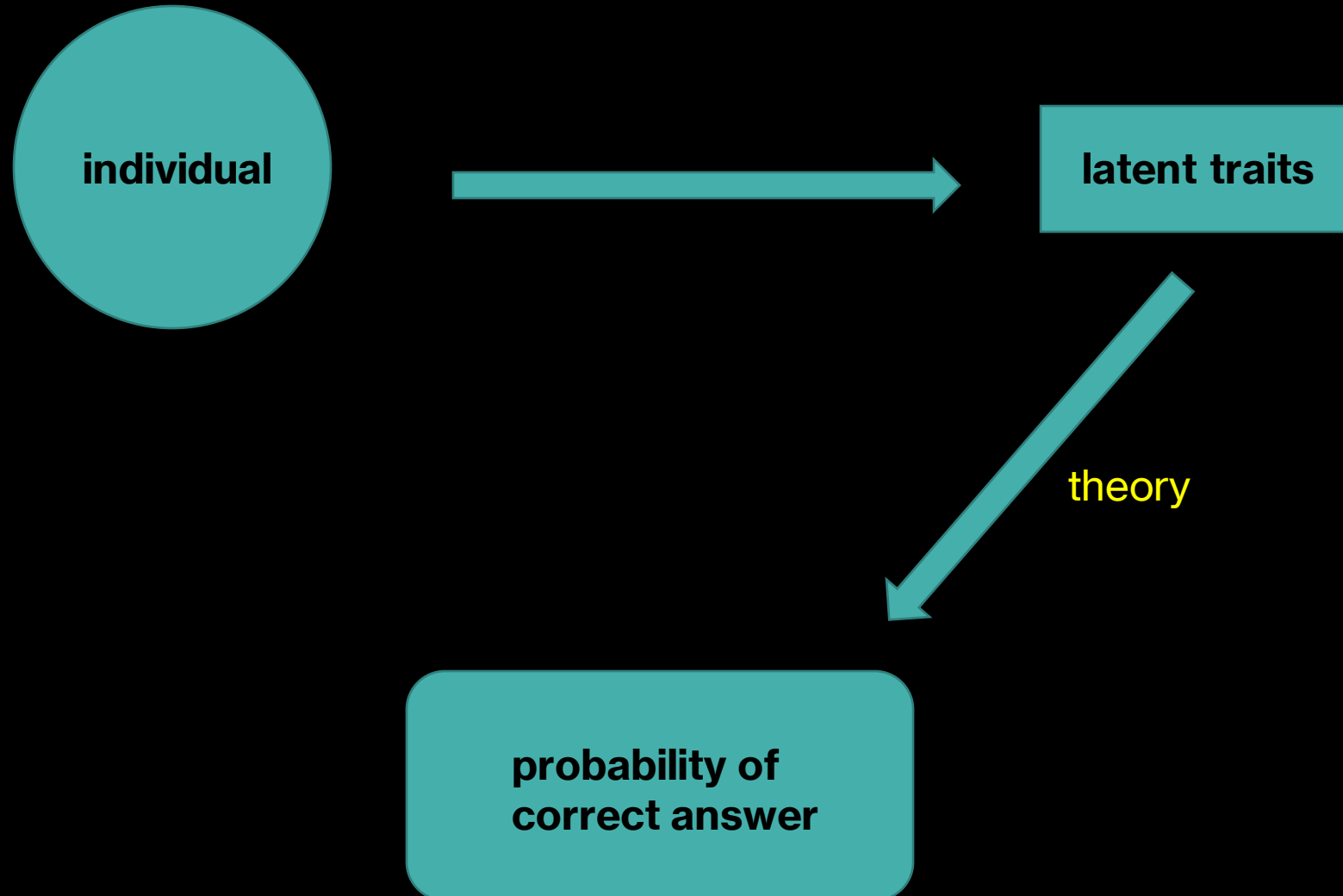
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CERN School of Computing 2022

Item Response Theory



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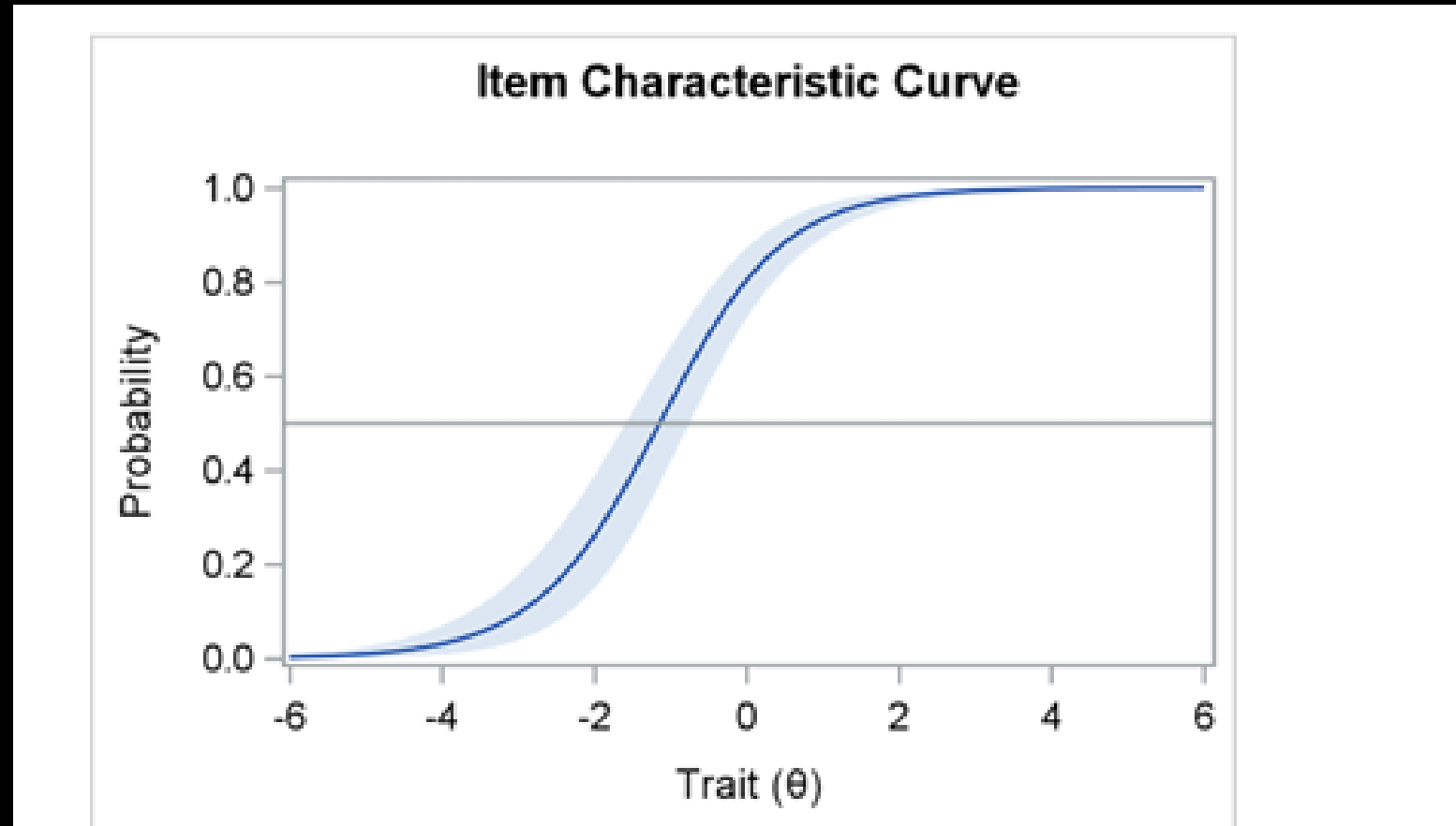
1. The performance of an individual in a test can be predicted by a set of variables

Item Response Theory

1. The performance of an individual in a test can be predicted by a set of variables

2. The relation between success and latent traits is described by a characteristic curve

Item Characteristic Curve in IRT



Item Response Theory

Logistic model for 3 parameters

a – discrimination

b – difficulty

c – guessing

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Logistic model for 3 parameters

a – discrimination
b – difficulty
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$$P(X = 1|\theta, a, b, c) = c + (1 - c) \frac{e^{a(\theta-b)}}{1 + e^{a(\theta-b)}}$$

Inputs

Lakehouse technology
Python



	Turma_Sequencia	Acertos	Disciplina	Assunto	Questao	Avaliacao	Aluno
0	344	1	EEL0004	LINGUAGEM E LÍNGUA: CONCEITOS	2531	exercicio	201001478428
1	344	1	EEL0004	LINGUAGEM E LÍNGUA: CONCEITOS	2535	exercicio	201001478428
2	344	0	EEL0004	LINGUAGEM E LÍNGUA: CONCEITOS	2530	exercicio	201001478428
3	344	1	EEL0004	LINGUAGEM E LÍNGUA: CONCEITOS	2534	exercicio	201001478428
4	344	1	EEL0004	LINGUAGEM E LÍNGUA: CONCEITOS	2532	exercicio	201001478428
...
1015052	298	0	EGT0004	SAÚDE PESSOAL	3705	exercicio	202205184609
1015053	298	1	EGT0004	SAÚDE PESSOAL	3694	exercicio	202205184609
1015054	298	1	EGT0004	SAÚDE PESSOAL	3706	exercicio	202205184609
1015055	298	1	EGT0004	SAÚDE PESSOAL	3707	exercicio	202205184609
1015056	298	0	EGT0004	SAÚDE PESSOAL	3715	exercicio	202205184609

1015057 rows × 7 columns

Outputs

- Several tables with **question quality** and **student's proficiency**

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- Several tables with **question quality** and **student's proficiency**

Aluno ▲	Questao ▲	Acertos ▲	Avaliacao ▲	Disciplina ▲	Theta_Final ▲
201007016124	4	3	exercicio	ARA0002	0.75
201101063335	3	1	exercicio	ARA0002	-0.19
201102080871	48	13	exercicio	ARA0002	-0.15
201151271616	10	5	exercicio	ARA0002	1.05
201201603421	38	20	exercicio	ARA0002	-0.02
201407002791	18	10	exercicio	ARA0002	0.4
201407342861	10	6	exercicio	ARA0002	0.66

Prospects

In the future, we will use the progress indicator to suggest to students the topics they should focus on. This suggestion will take place in the University's virtual platform, allowing personalization of the student's environment, and recognizing the uniqueness of each student.