Less is more

Una procedura Item Response Theory per lo sviluppo di forme brevi di test

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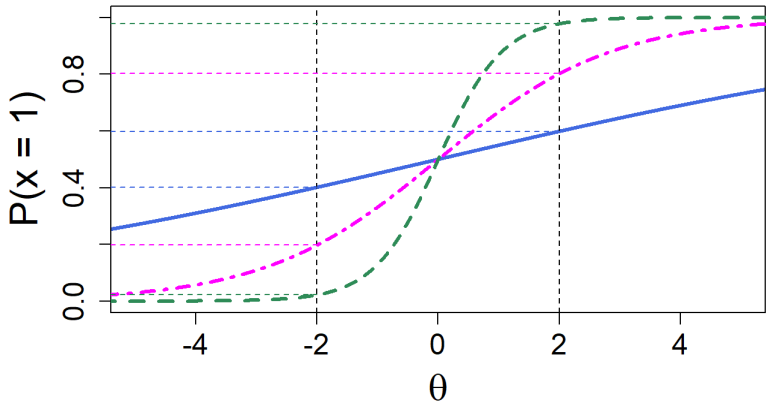
I modelli dell'Item Response Theory (IRT) e informatività dell'item

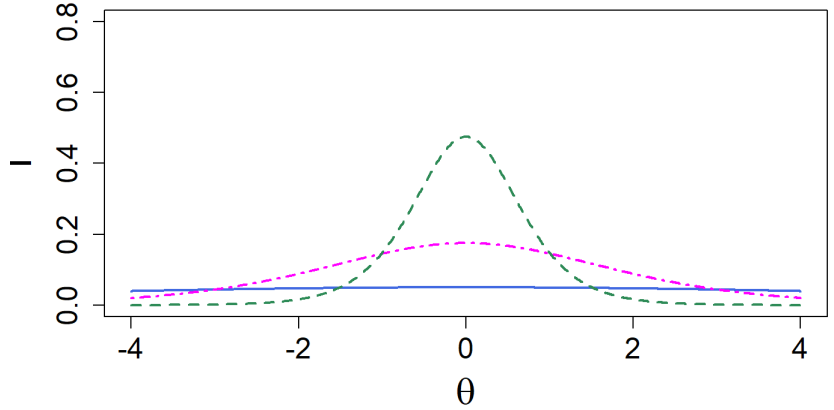
2PL

$$P(x = 1|\theta_p, b_i, a_i) = \frac{exp[a_i(\theta_p - b_i)]}{1 + exp[a_i(\theta_p - b_i)]}$$



Item Information Function

$$I_i(\theta) = a^2 P_i(\theta)(1 - P_i(\theta))$$



In pratica

b1

-3 0 3

-3 -2.4 -1.8 -1.2 -0.6 0 0.6 1.2 1.8 2.4 3

b2

-3 0 3

-3 -2.4 -1.8 -1.2 -0.6 0 0.6 1.2 1.8 2.4 3

b3

-3 0 3

-3 -2.4 -1.8 -1.2 -0.6 0 0.6 1.2 1.8 2.4 3

a1

0.2 1 3

0.2 0.5 0.8 1.1 1.4 1.7 2 2.3 2.6 2.93

a2

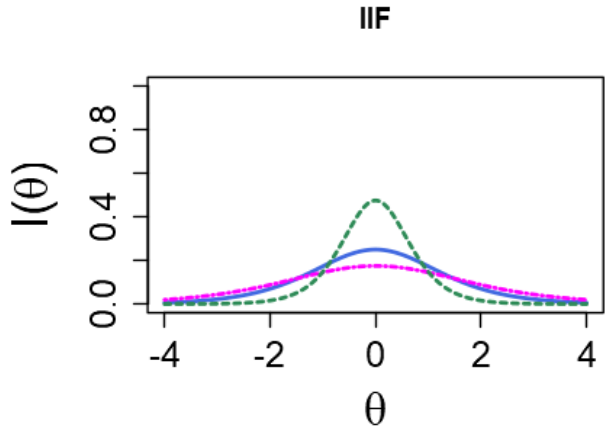
0 0.7 3

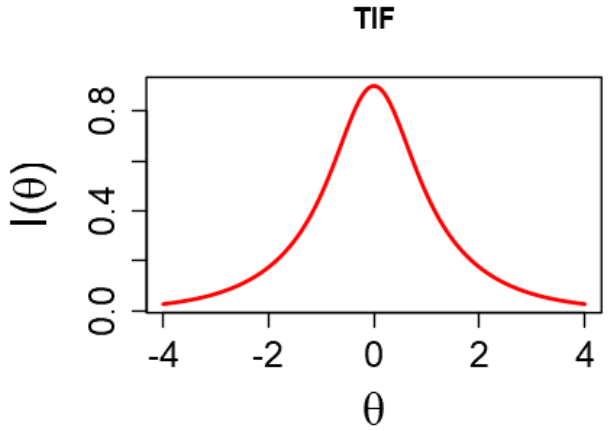
0 0.3 0.6 0.9 1.2 1.5 1.8 2.1 2.4 2.7 3

a3

0 1.9 3

0 0.3 0.6 0.9 1.2 1.5 1.8 2.1 2.4 2.7 3





Creare forme brevi

Strategia classica $item = max(I(\theta))$

	b	a	IIF
item 1	**-0.666**	**0.714**	**0.110**
item 2	**0.498**	**1.192**	**0.265**
item 3	-2.432	0.254	0.015
item 4	**2.116**	**1.978**	**0.155**
item 5	1.720	0.385	0.032
item 6	**-2.284**	**1.617**	**0.129**
item 7	0.639	0.500	0.058
item 8	**-2.514**	**1.678**	**0.101**
item 9	-0.655	0.436	0.045
item 10	0.717	0.326	0.026

Creare forme brevi

Strategie basate su θ target

	θ_1	θ_2	θ_3	θ_4	θ_5
item1	0.067	0.111	0.1	0.127	0.121
item2	0.222	0.09	0.348	0.205	0.32
item3	0.012	0.016	0.014	0.015	0.015
item4	0.825	0.002	0.229	0.012	0.053
item5	0.037	0.025	0.036	0.03	0.033
item6	0.004	0.528	0.019	0.201	0.067
item7	0.058	0.045	0.062	0.055	0.061
item8	0.002	0.457	0.012	0.143	0.043
item9	0.037	0.045	0.043	0.047	0.047
item10	0.026	0.023	0.027	0.025	0.026

Metodo

Studio di simulazione

Classica vs. Cluster vs. Intervalli costanti vs. Random

1000 Soggetti:

- $\mathcal{N}\{0, 1\}$
- $Beta(1, 100)$ (trasformata linearmente per ottenere valori negativi)
- $\mathcal{U}\{-3, 3\}$

100 Item:

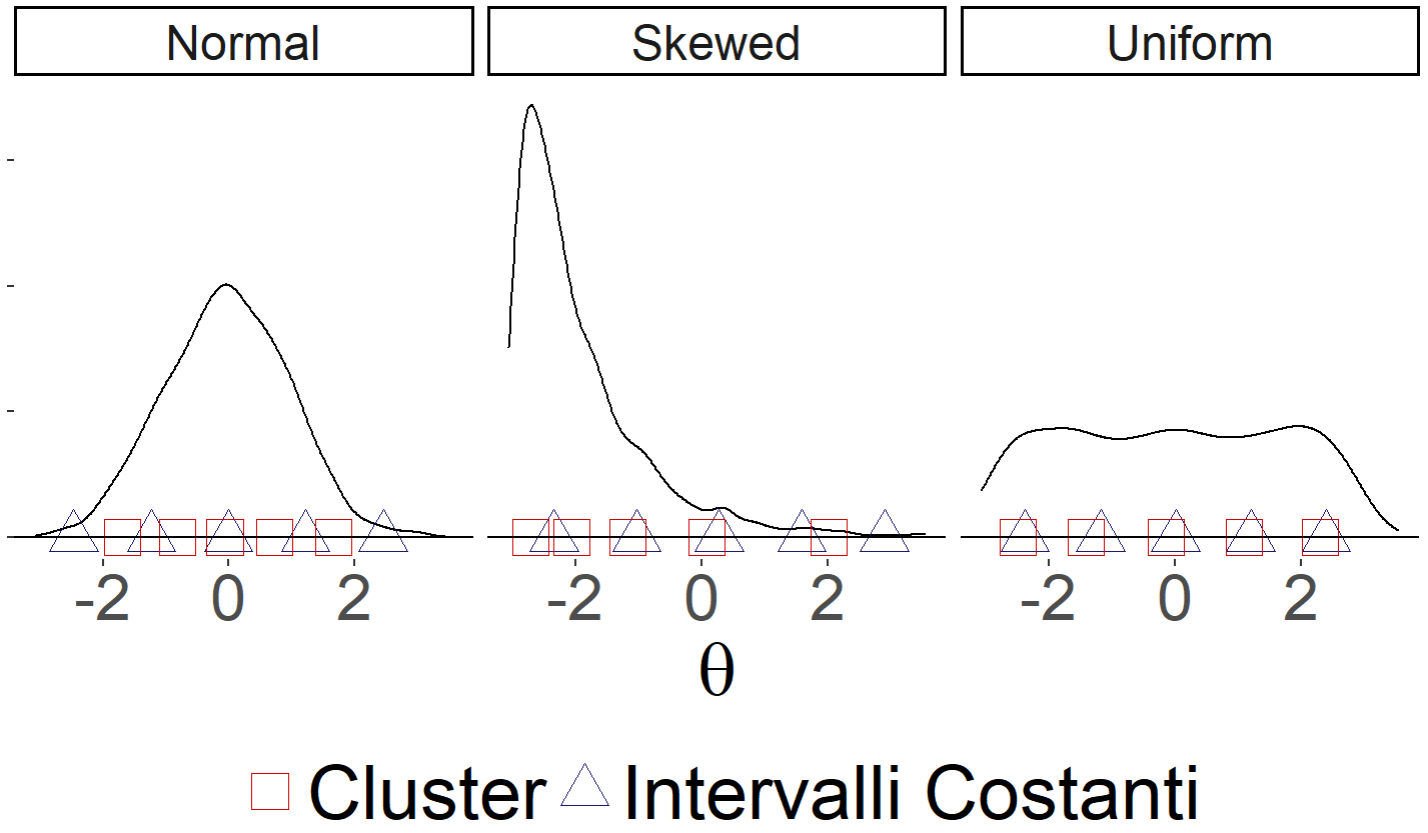
$b = \mathcal{U}\{-3, 3\}$

$a = \mathcal{U}\{.40, 2\}$

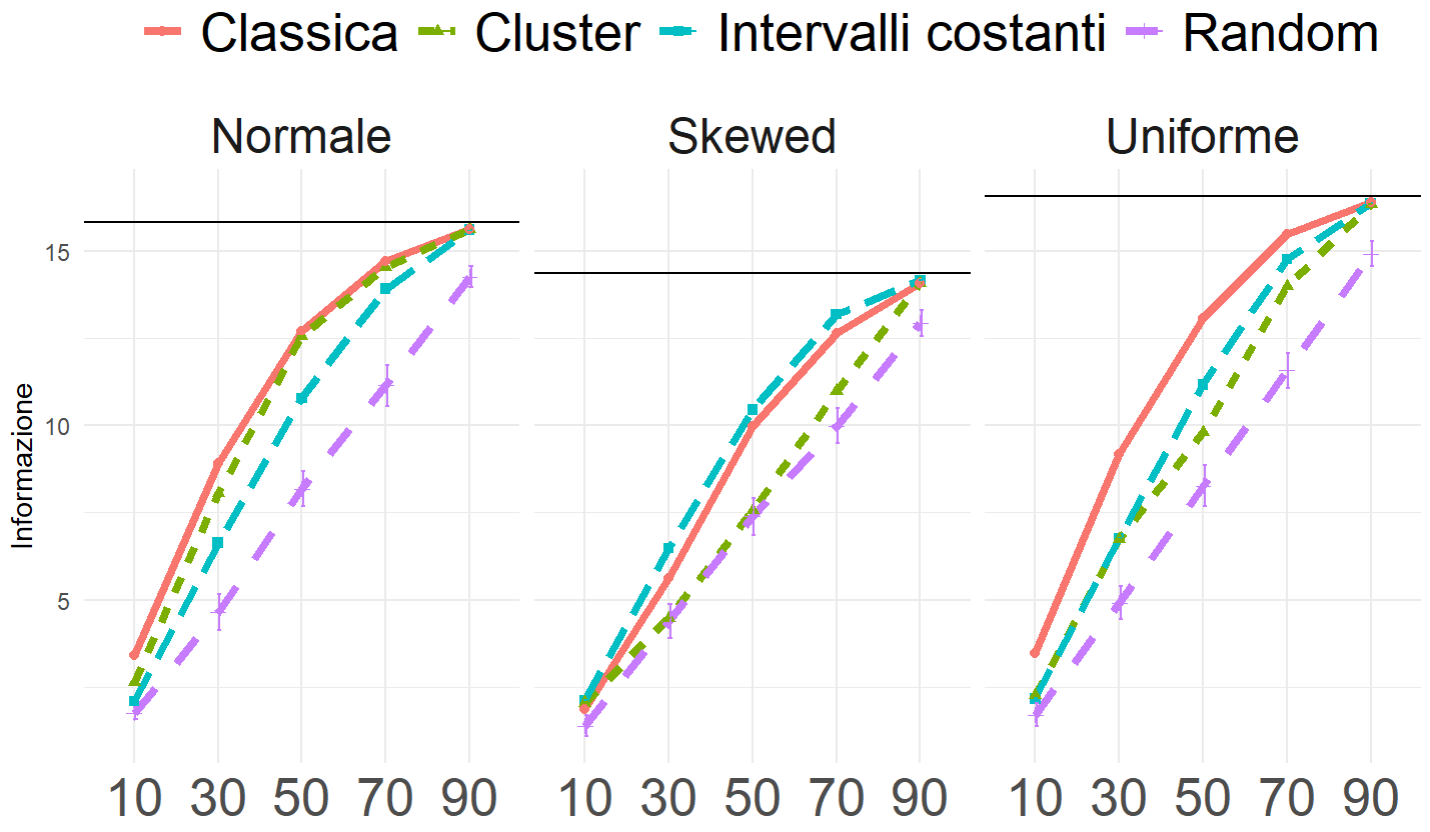
Obiettivo $\rightarrow$ creare forme brevi per ridurre da 100 item a 90, 70, 50, 30, 10 item

La random estrae 10 combinazioni di item per ogni numerosità

Il tratto latente



Information



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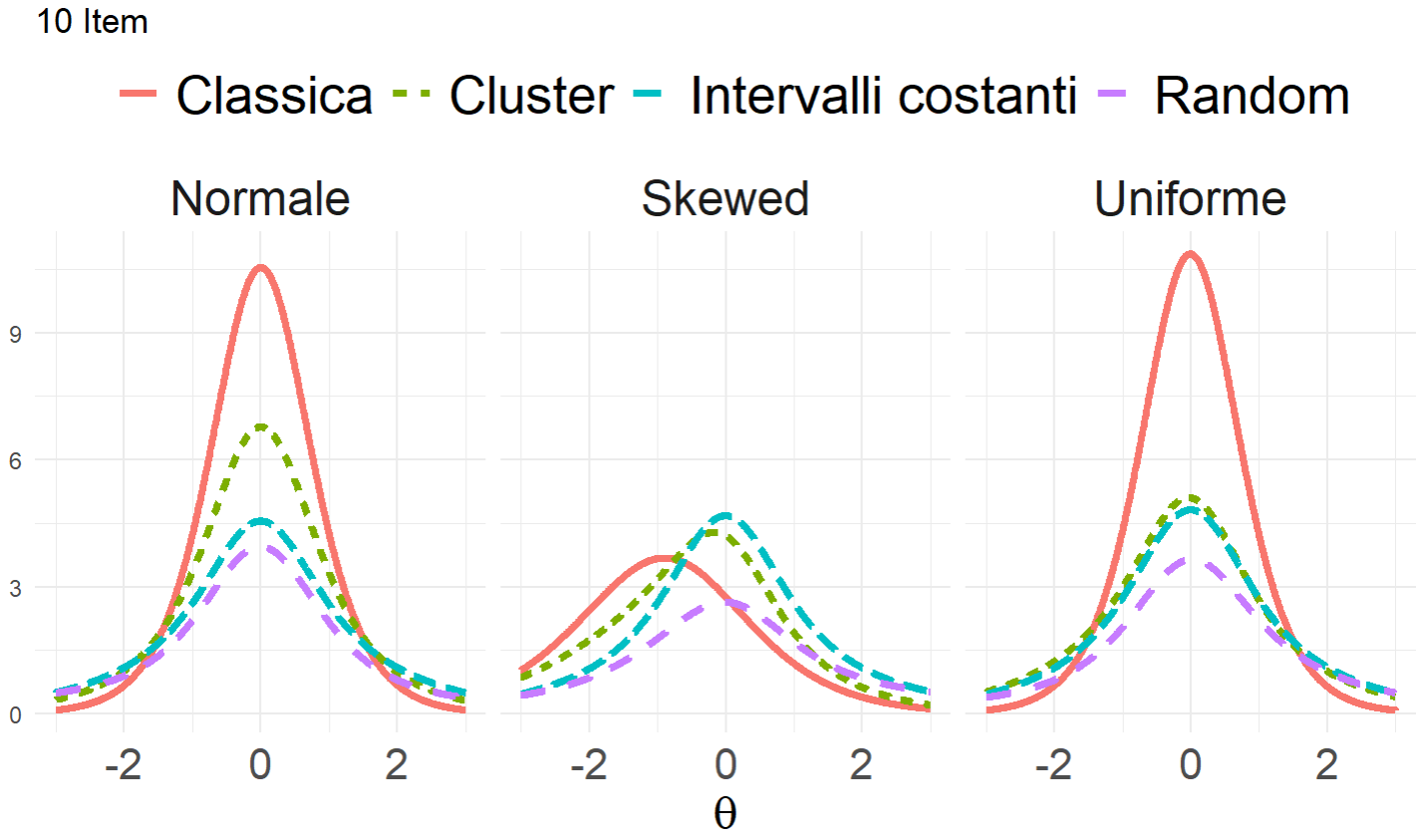
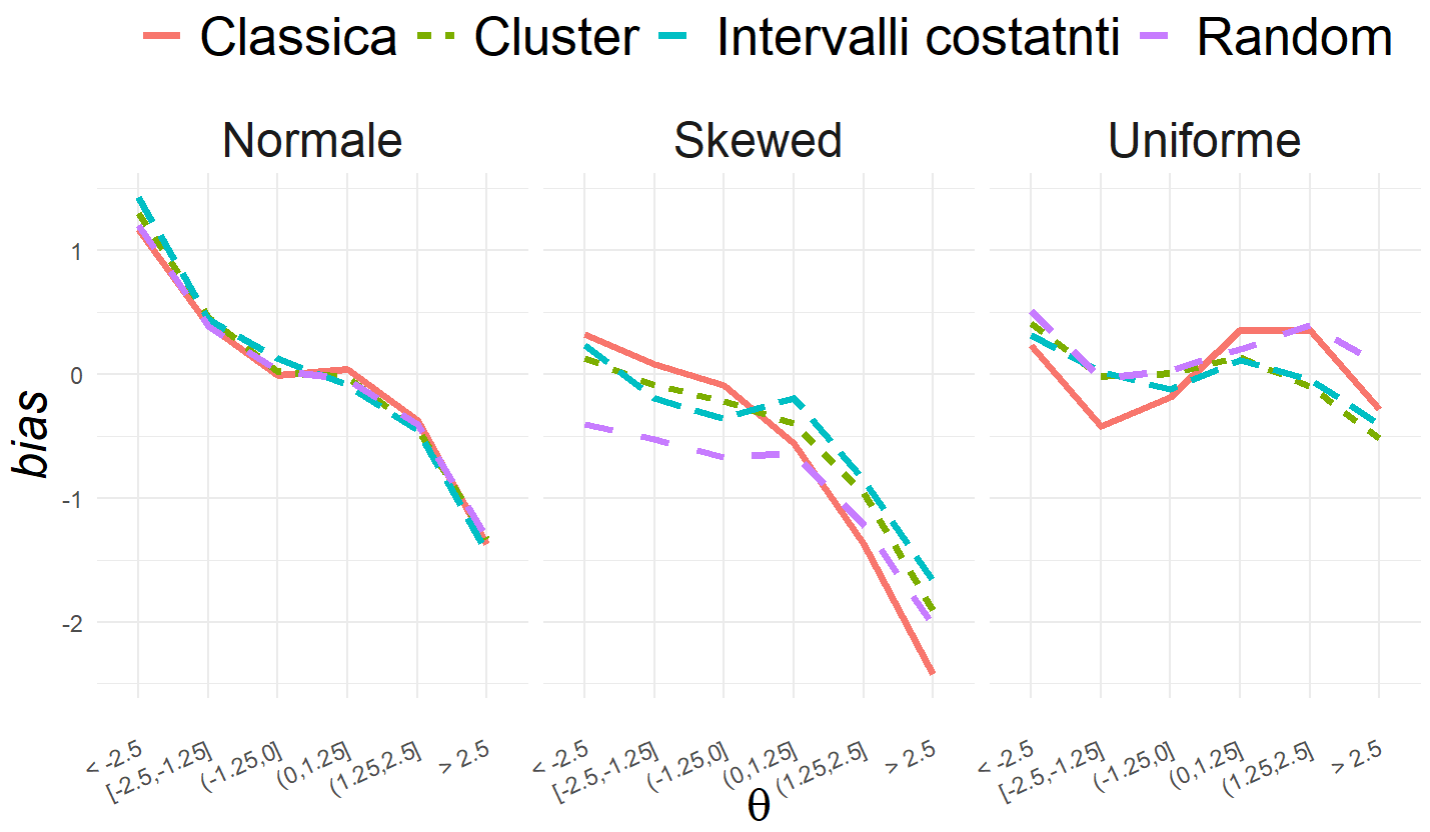

10 Item
Classica
Cluster
Intervalli costanti
Random
Normale
Skewed
Uniforme
9
6
3
0
-2
0
2
θ

Bias gruppi di θ



Conclusioni

- Diversi metodi di selezione funzionano più o meno bene a seconda della distribuzione di θ
- Costruire test o forme brevi per specifici punti del tratto di latente
- Suggerimenti? Dati?
- La strategia inversa