

Collectieve Intelligentie

Deel 3: Evaluatie

Waar waren we?

Search  

Mark Rober Meditation music Universe Shapes Cargo ships Calculus Machine learning History Can

Jacobian

What derivatives and integrals REALLY are

27:14

What is Jacobian? | The right way of thinking derivatives and integrals

Mathemaniac 45K views • 1 week ago

INTELLIGENZ

Was ist Intelligenz?

Dinge Erklärt – Kurzgesagt 280K views • 1 day ago

#zml

Janssen-vaccin | Zondag met Lubach (S13)

vpro zondag met lubach 428K views • 2 weeks ago

Angular Momentum Demo: Hoberman Sphere

Physics Demos 159K views • 4 years ago

I found the BEST coronavirus depiction (+ explanation)

MinuteEarth 151K views • 3 weeks ago

She has NOT combed her hair since LAST SUMMER! (3 HOURS to...

Deeper Than Hair TV 2M views • 1 week ago

Booking.com EUR ? ₩

Snelle en gemakkelijke reisplanner

Kies een vibe en ontdek de topbestemmingen in Italië

Romantiek Stad Skiën Strand Relax Buiten






vacatures ontwikkel jezelf

personeel gezocht

Snel personeel gezocht voor jouw team of bedrijf? Dan de goede plek. We helpen dagelijks kleine en grote bedrijf verschillende branches door heel Nederland aan personeel helpen we graag! Meld je vacature gratis online aan wij juiste talent voor jouw organisatie

Doel

Business goal: meer producten verkopen.

Operational goal:

relevance -> producten aanbevelen waar de gebruiker blij mee is

novelty -> nieuw/nog niet eerder gezien

diversity -> gevarieerd aanbod

serendipity -> verassend/ook nooit verwacht

Doel

Business goal: meer producten verkopen.

Operational goal:

relevance -> producten aanbevelen waar de gebruiker blij mee is

novelty -> nieuw/nog niet eerder gezien

diversity -> gevarieerd aanbod

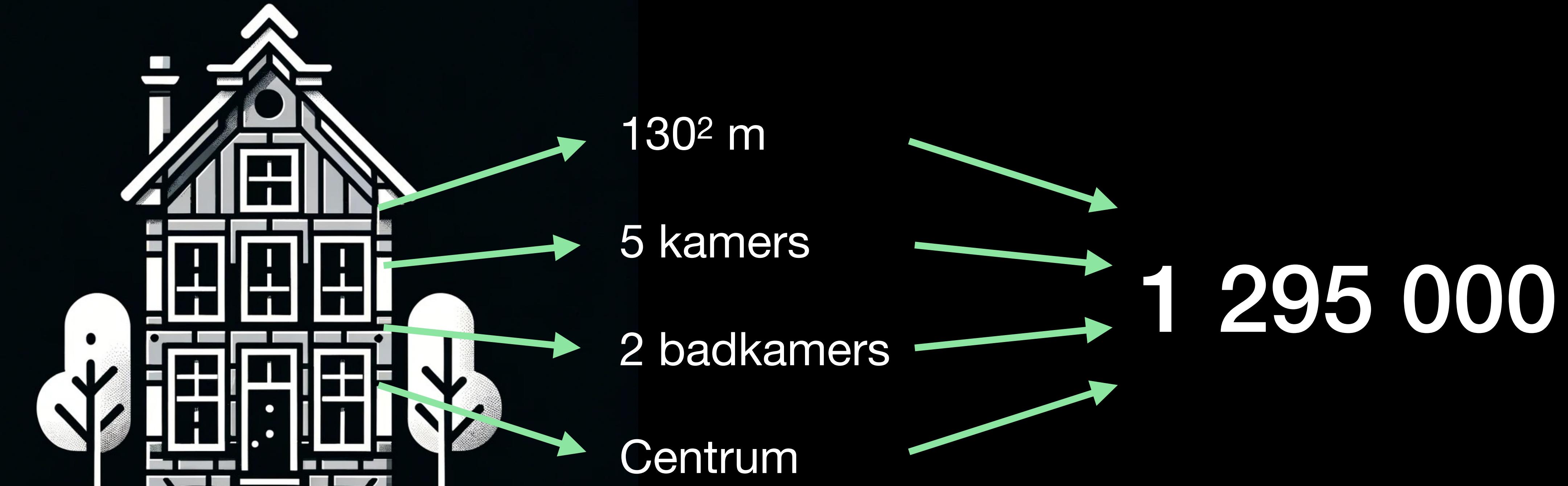
serendipity -> verassend/ook nooit verwacht

(no bias) -> voorkomen van vooroordeLEN

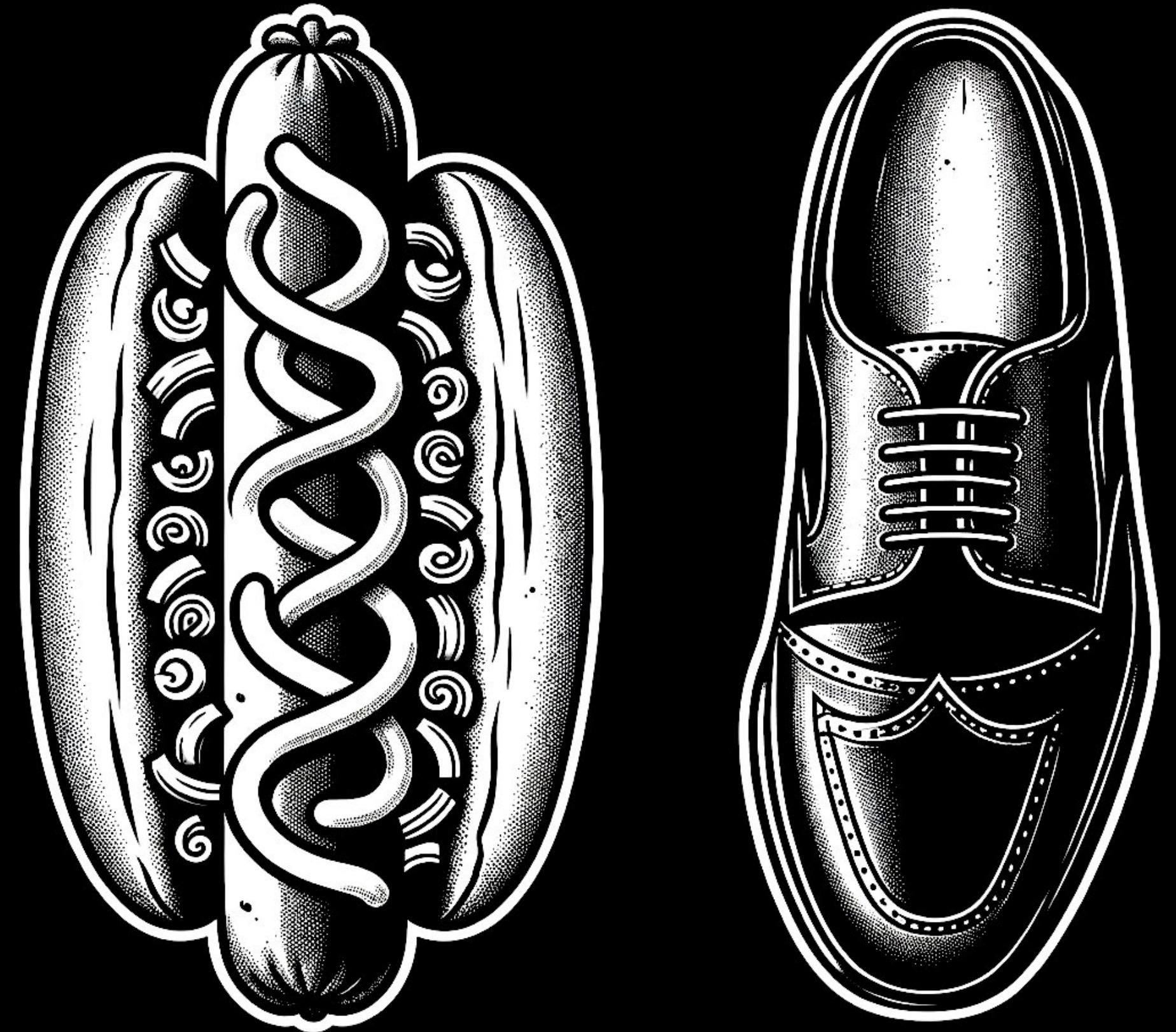
(no bubble) -> voorkomen van filter bubbles

...

Type algoritmes



Regressie



hotdog!

not a hotdog!

Classificatie



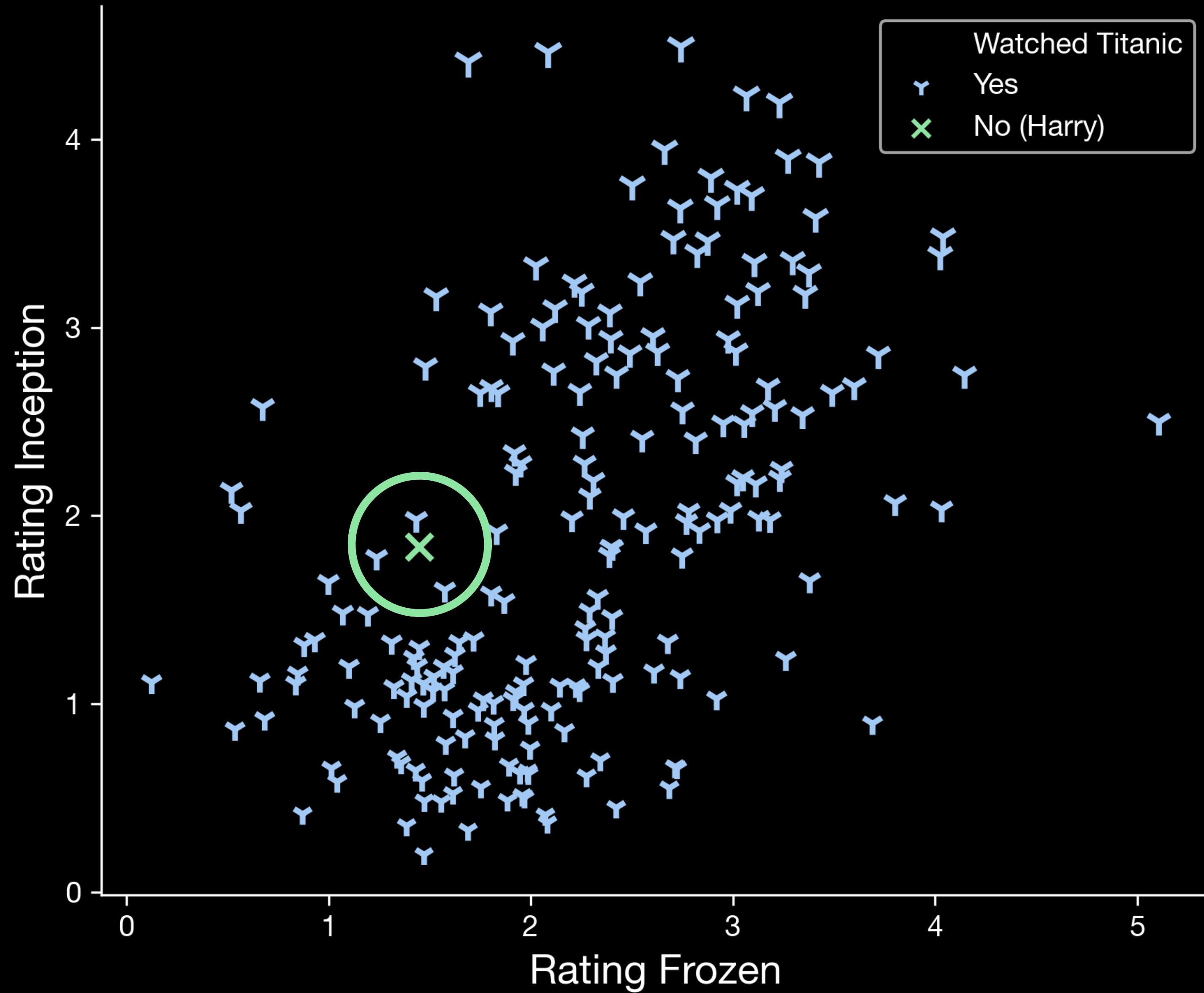
Harry

Marathonloper of K1-vechter?

KNN

KNN - Movies

Standaard *machine learning* classificatie-algoritme



Rating Similarity

2.014	5.7142
2.629	5.4824
1.382	3.4352

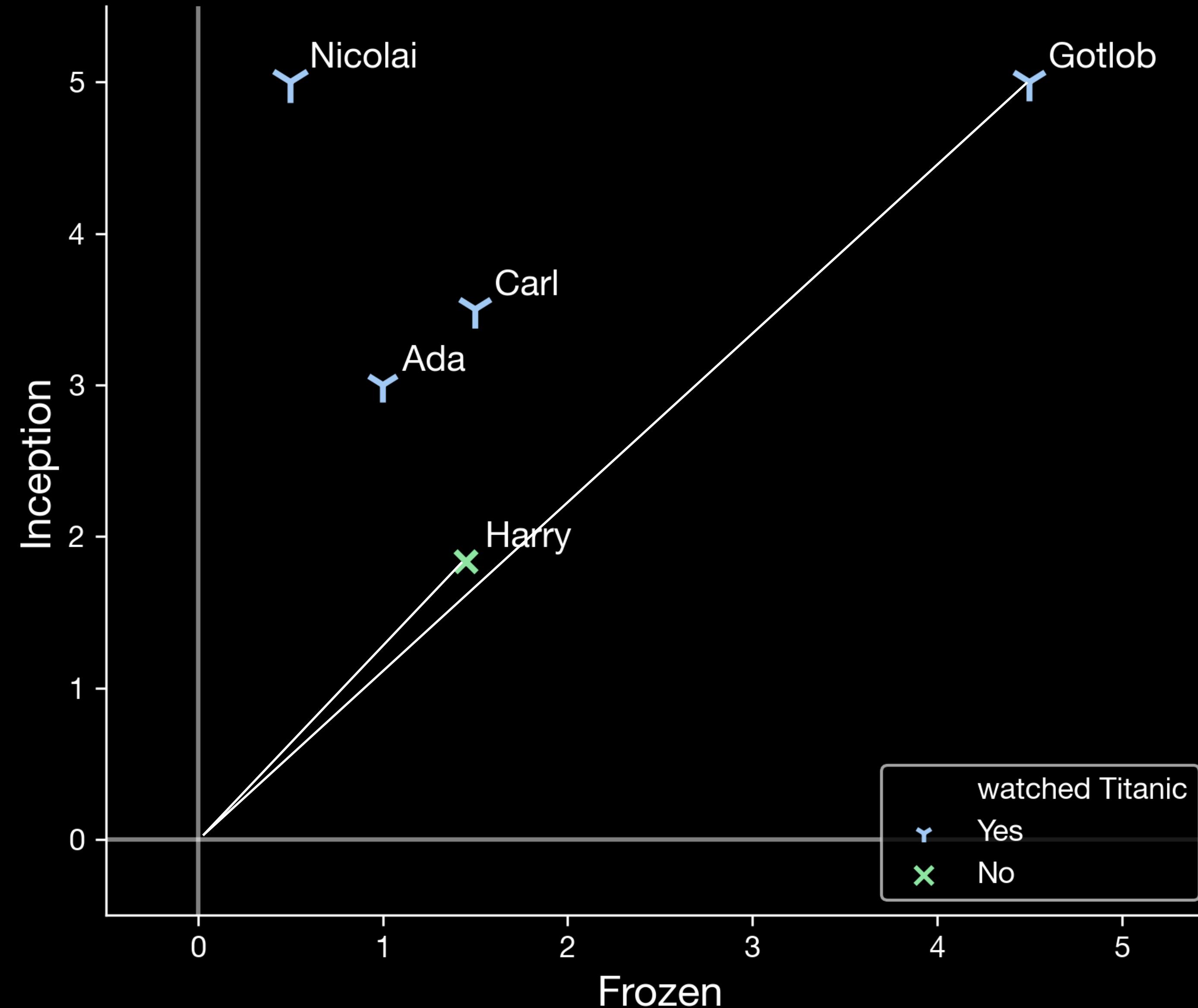
2.0960

threshold (> 3.5)

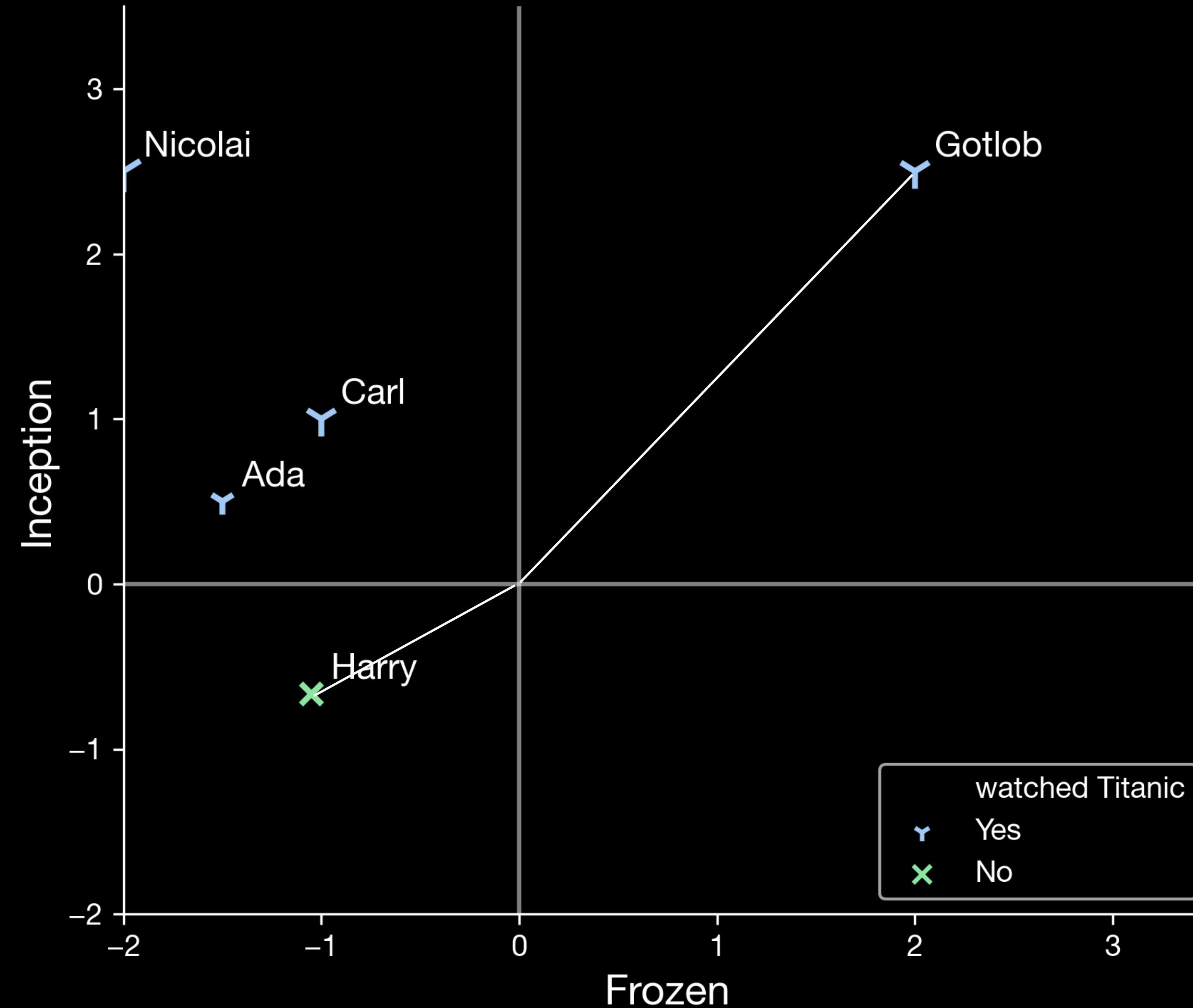
Geen aanbeveling

Cosine similarity

$$Cos(u, v) = \frac{\sum_{i \in I_u \cap I_v} (r_{u,i} - \mu_u) \cdot (r_{v,i} - \mu_v)}{\sum_{i \in I_u \cap I_v} (r_{u,i} - \mu_u)^2 \cdot \sum_{i \in I_u \cap I_v} (r_{v,i} - \mu_v)^2}$$



Mean centering



Wat verder?

Module 1:
KNN

Module 2:
Evaluatie

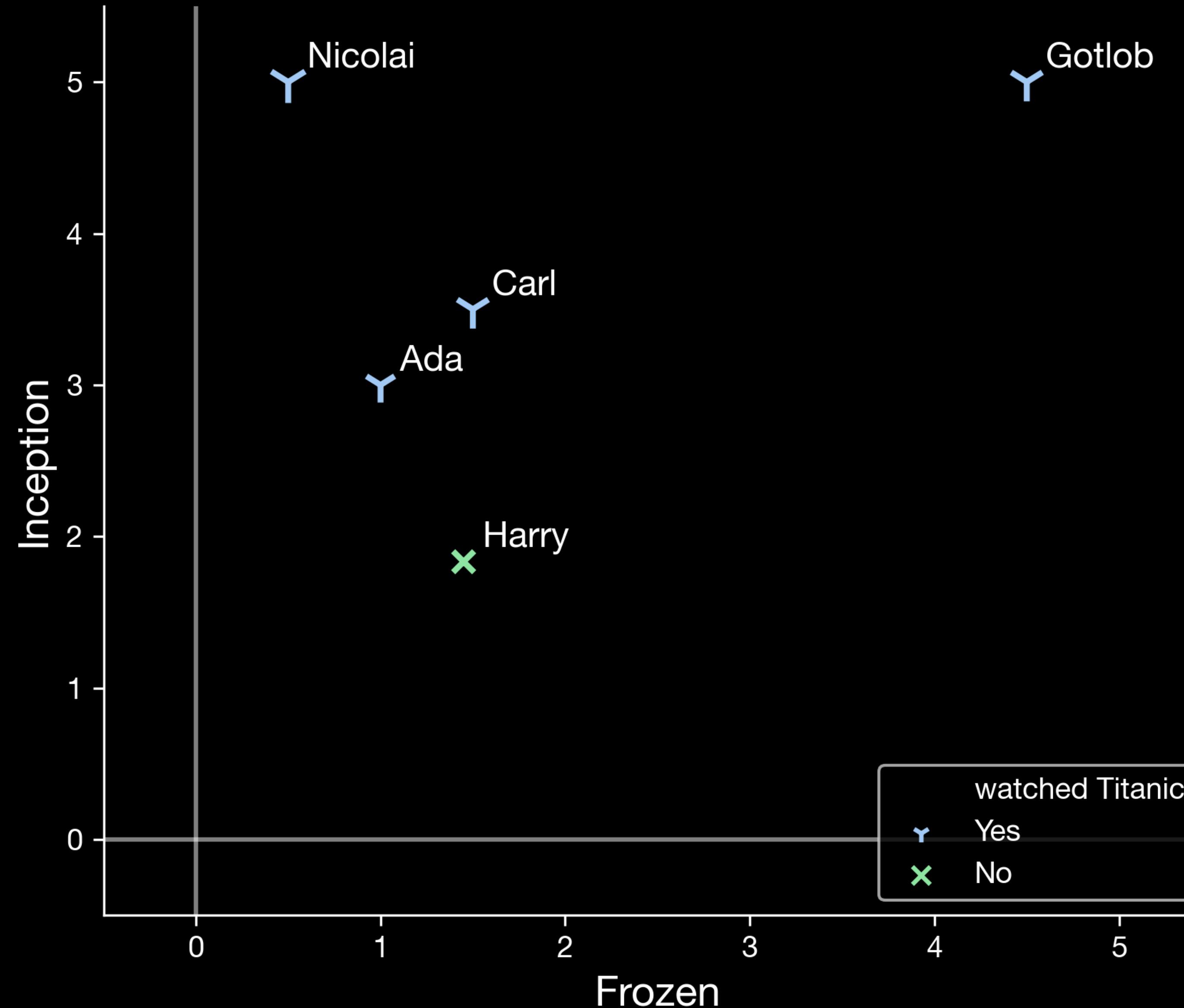
Module 3:
Content-based

Module 4:
Matrix-
factorisatie 1

Module 5:
Matrix-
factorisatie 2

KNN

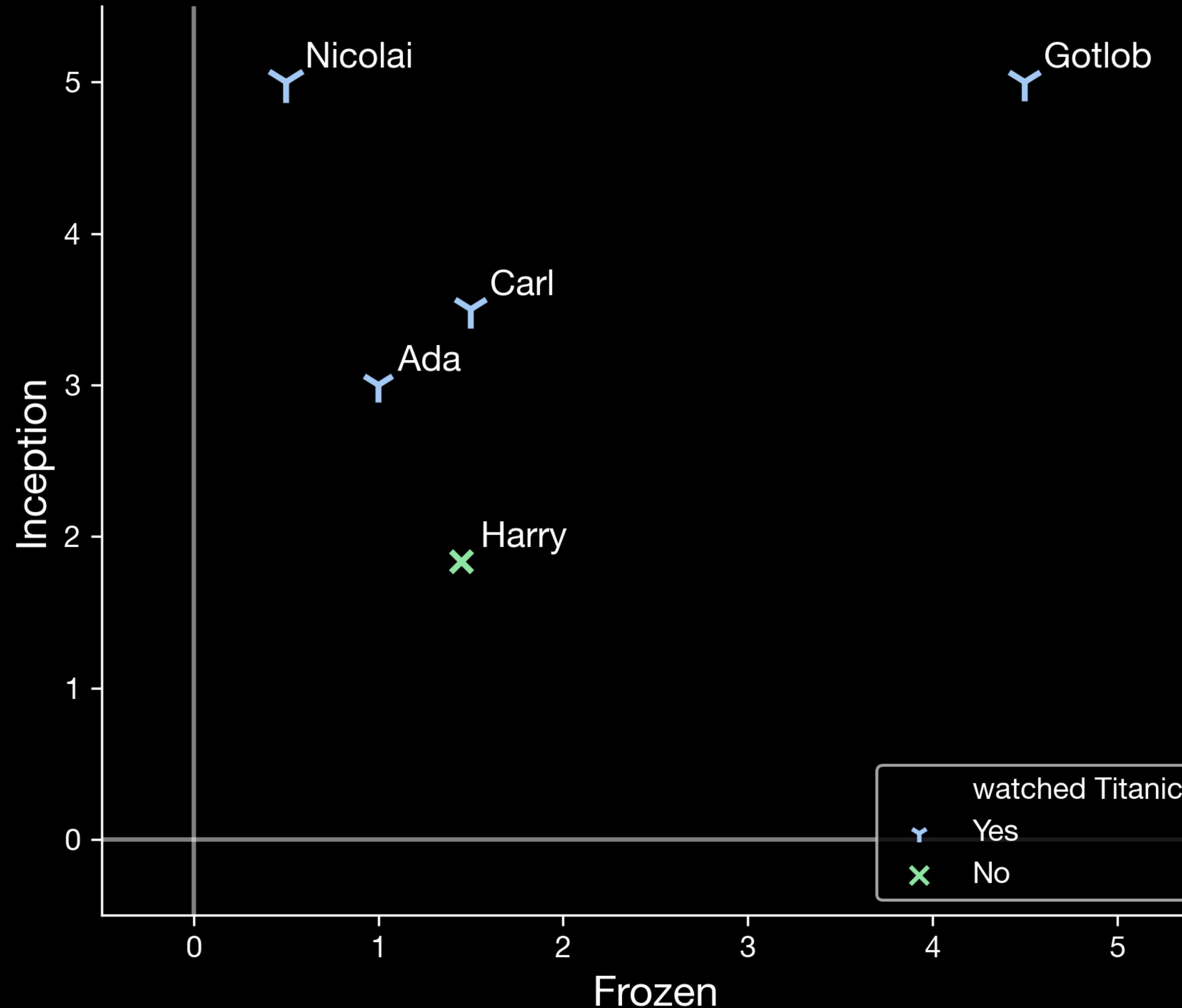
voorspelling van
ratings



	Frozen	Inception	Titanic
Ada	1.00	3.00	3.00
Carl	1.50	3.50	4.00
Gotlob.	4.50	5.00	4.00
Harry	1.45	1.83	?
Nicolai	0.50	5.00	5.00

KNN

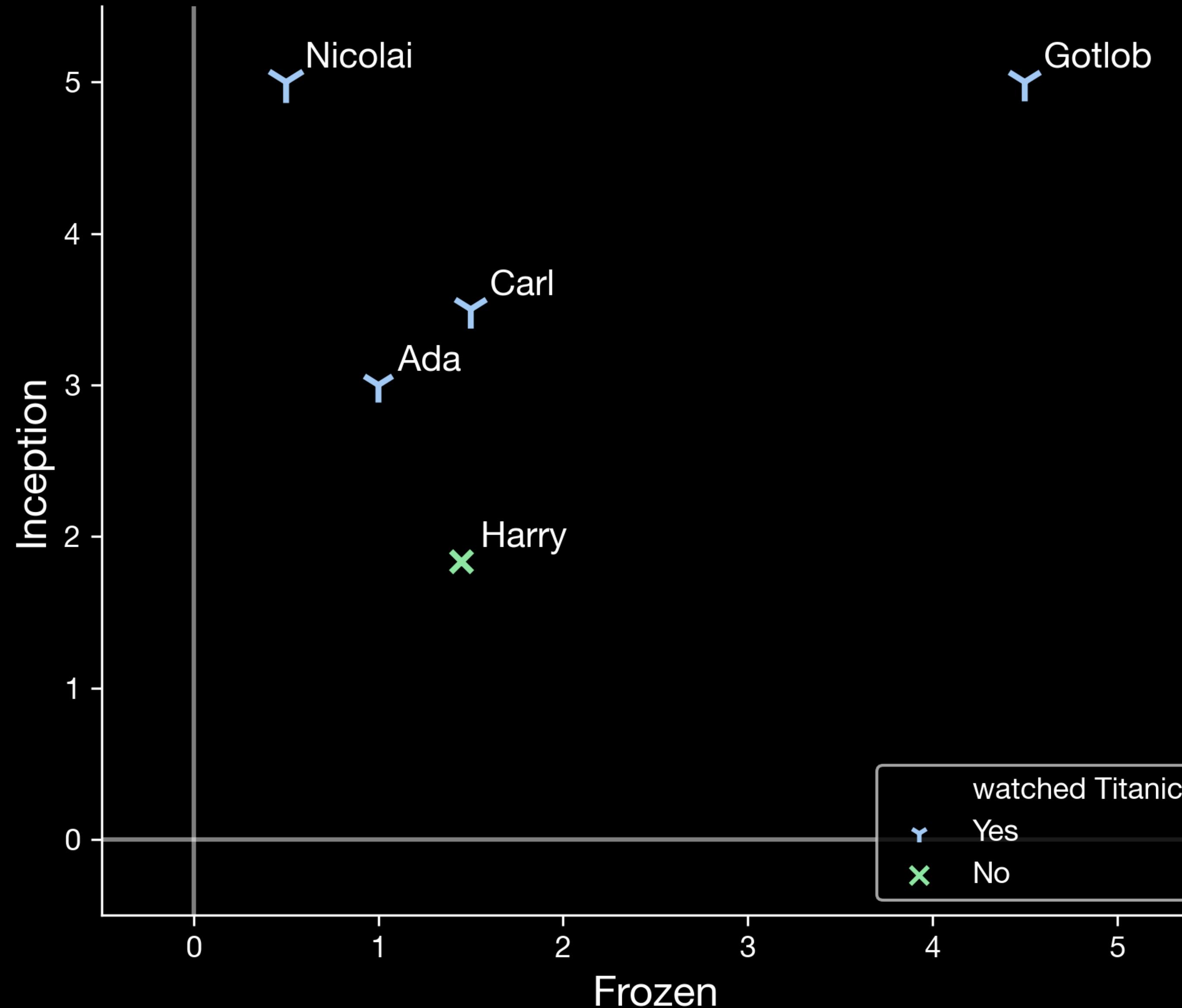
voorspelling van
ratings
(regressie)

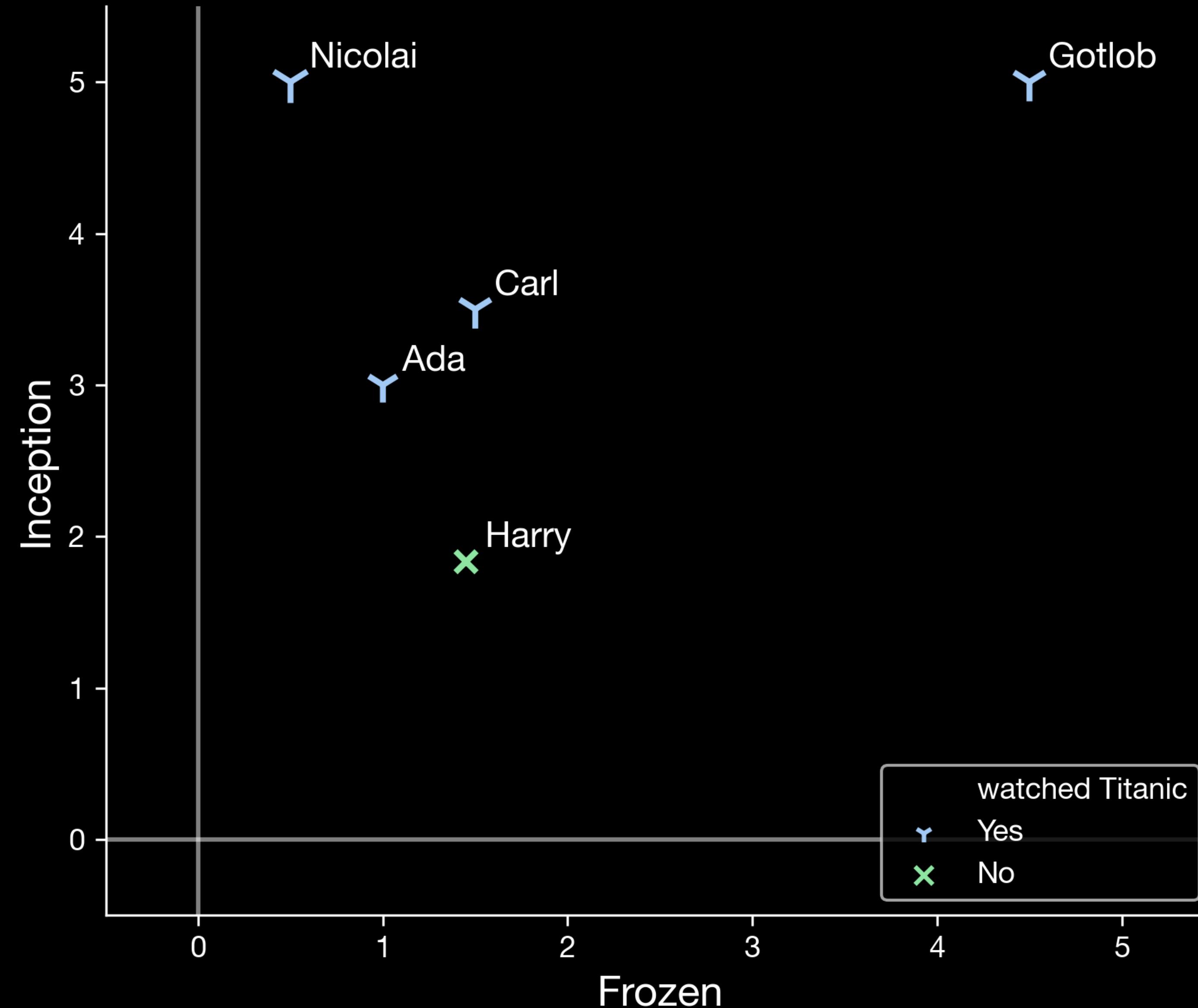


	Frozen	Inception	Titanic
Ada	1.00	3.00	3.00
Carl	1.50	3.50	4.00
Gotlob.	4.50	5.00	4.00
Harry	1.45	1.83	?
Nicolai	0.50	5.00	5.00

KNN

voorspelling van
ratings
(regressie)





KNN

**voorspelling van
aanbevelingen
(nog niet gedaan)**

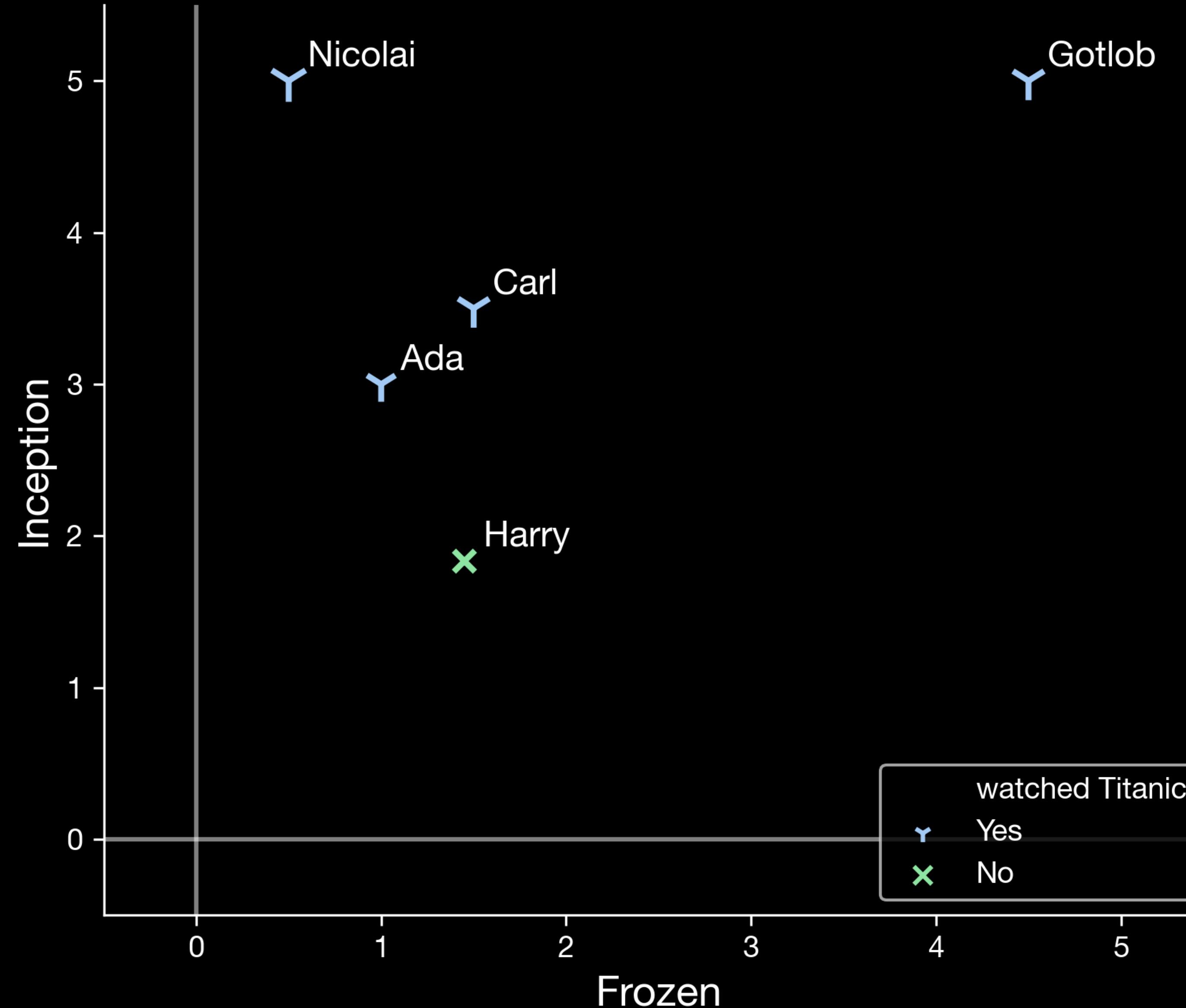
	Frozen	Inception	Titanic
Ada	1.00	3.00	3.00
Carl	1.50	3.50	4.00
Gotlob.	4.50	5.00	4.00
Harry	1.45	1.83	2.09
Nicolai	0.50	5.00	5.00

Threshold:

prediction > 3.5?

KNN

voorspelling van
aanbevelingen
(classificatie)



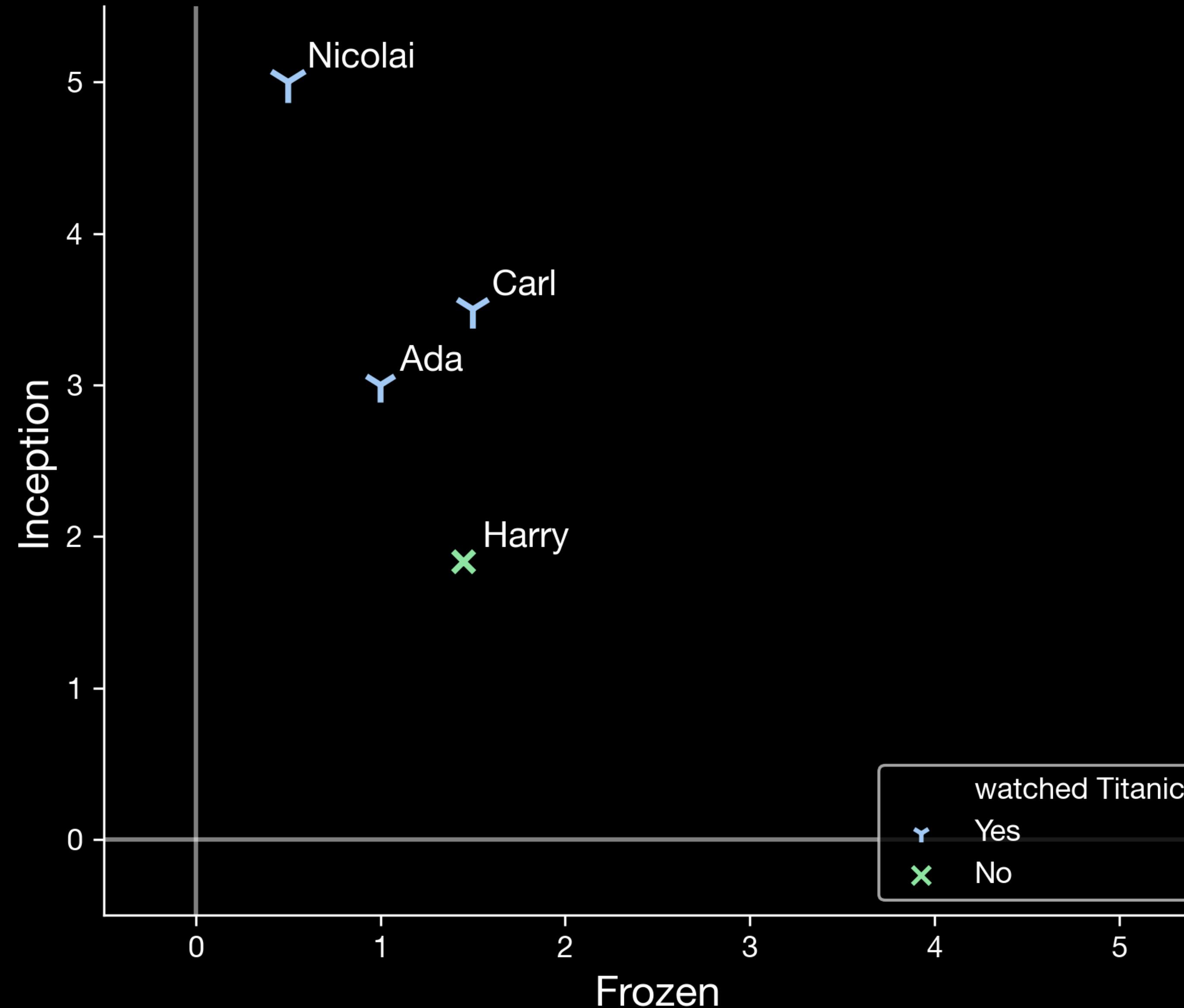
	Frozen	Inception	Titanic
Ada	1.00	3.00	3.00
Carl	1.50	3.50	4.00
Gotlob.	4.50	5.00	4.00
Harry	1.45	1.83	2.09
Nicolai	0.50	5.00	5.00

Threshold:

prediction > 3.5?

KNN

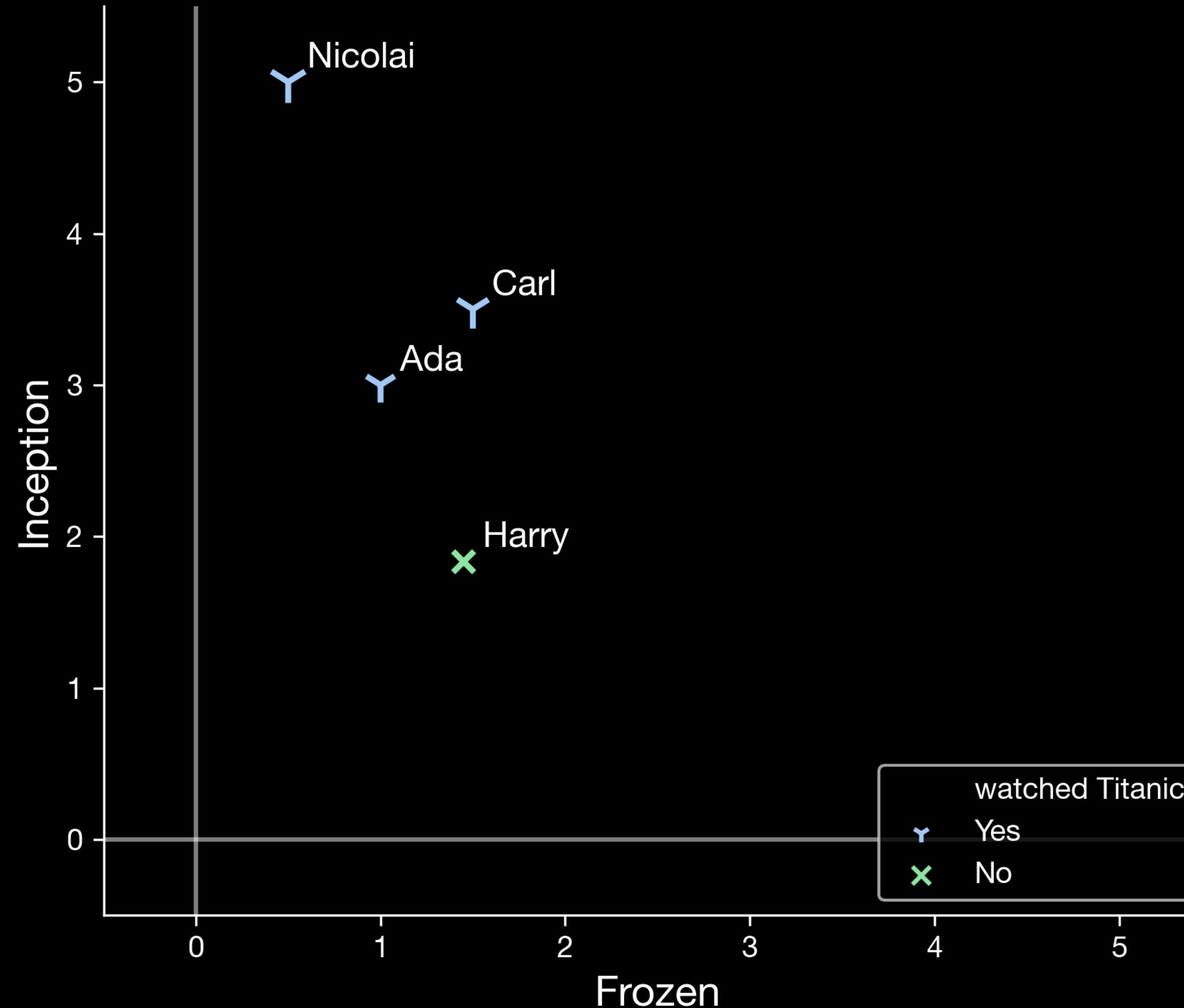
voorspelling van ratings



	Frozen	Inception	Titanic
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Carl	1.50	3.50	4.00
Gotlob	?	5.00	4.00
Harry	1.45	1.83	?
Nicolai	0.50	5.00	5.00
Leo	2.50	2.00	3.00
Laura	?	3.50	4.00
Maurits	4.50	?	?
Marion	5.00	4.20	?
Carlo	4.50	?	4.00
...			

KNN

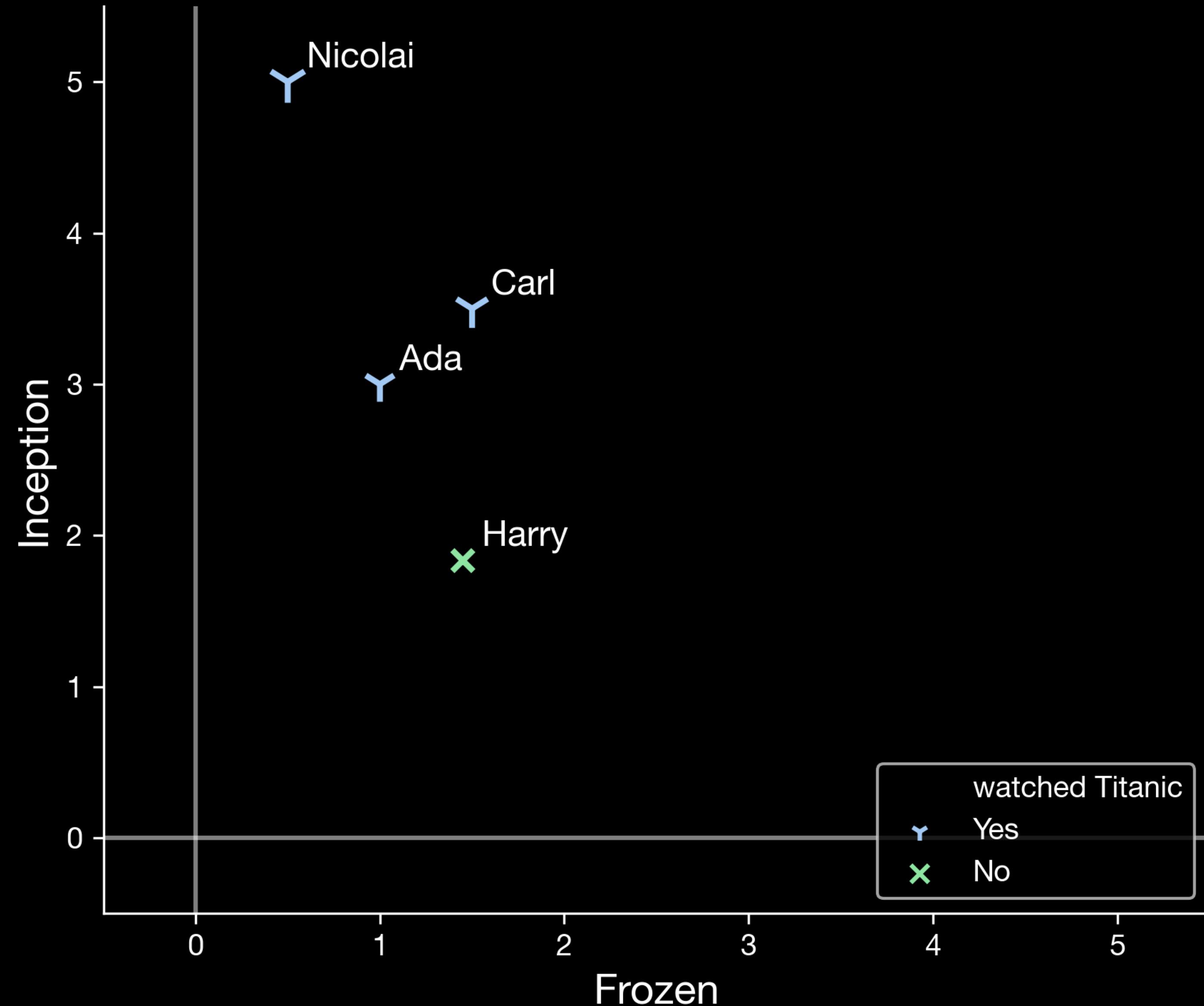
voorspelling van ratings



	Frozen	Inception	Titanic
Ada	1.00	3.00	3.00
Carl	1.50	3.50	4.00
Gotlob	1.84	5.00	4.00
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Nicolai	0.50	5.00	5.00
Leo	2.50	2.00	3.00
Laura	4.10	3.50	4.00
Maurits	4.50	3.64	4.52
Marion	5.00	4.20	4.06
Carlo	4.50	3.01	4.00
...			

KNN

**voorspelling van
aanbevelingen**



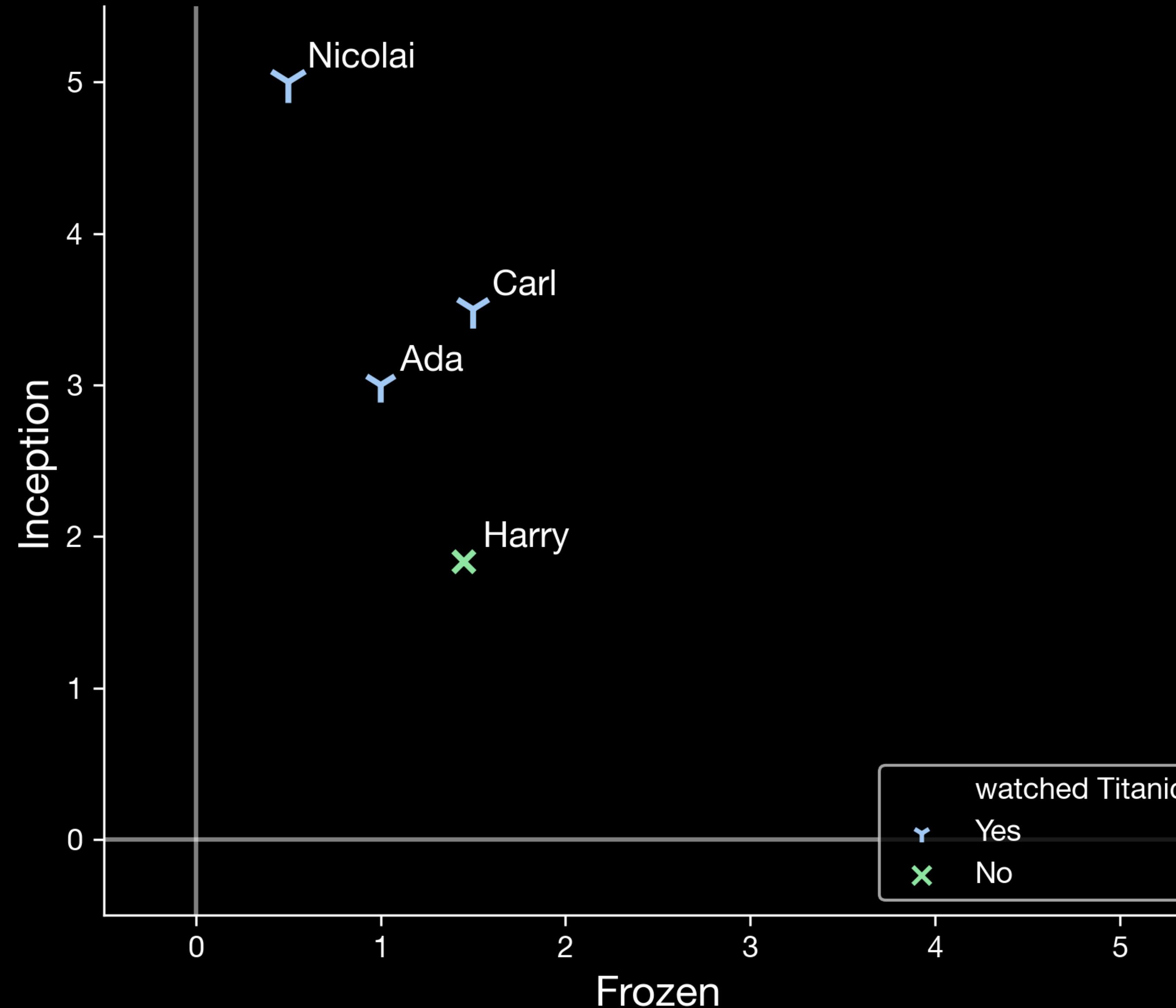
	Frozen	Inception	Titanic
Ada			
Carl			
Gotlob			✗
Harry			
Nicolai			
Leo			
Laura			✓
Maurits			✓
Marion			✓
Carlo			✗
...			
Threshold:			prediction > 3.5?

Evaluatie (regressie)

$$MSE = \frac{\sum_{(i,u) \in Test} (r_{i,u} - p_{i,u})^2}{|Test|}$$

Evaluatie

zijn dit goede
voorspellingen?



	Frozen	Inception	Titanic
Ada	1.00	3.00	3.00
Carl	1.50	3.50	4.00
Gotlob	1.84	5.00	4.00
Harry	1.45	1.83	2.09
Nicolai	0.50	5.00	5.00
Leo	2.50	2.00	3.00
Laura	4.10	3.50	4.00
Maurits	4.50	3.64	4.52
Marion	5.00	4.20	4.06
Carlo	4.50	3.01	4.00
...			

Evaluatie

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5	3.5		4.0	3.0	4.5	2.5
105			4.5	3.5	5.0	5.0		3.5
177	5.0	3.5	3.0		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0	4.5	3.0	3.5
232	3.5	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0	3.5			5.0
298	2.0	0.5	4.0	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5	3.5	4.0	4.5	3.0	3.5

Evaluatie

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5	3.5		4.0	3.0	4.5	2.5
105			4.5	3.5	5.0	5.0		3.5
177	5.0	3.5	3.0		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0	4.5	3.0	3.5
232	3.5	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0	3.5			5.0
298	2.0	0.5	4.0	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5	3.5	4.0	4.5	3.0	3.5

Evaluatie (test data)

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5	3.5		4.0	3.0	4.5	2.5
105			4.5	3.5	5.0	5.0		3.5
177	5.0	3.5	3.0		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0	4.5	3.0	3.5
232	3.5	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0	3.5			5.0
298	2.0	0.5	4.0	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5	3.5	4.0	4.5	3.0	3.5

Evaluatie (training)

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5	3.5		4.0	3.0	4.5	2.5
105			4.5	3.5	5.0	5.0		3.5
177	5.0	3.5	3.0		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0	4.5	3.0	3.5
232	3.5	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0	3.5			5.0
298	2.0	0.5	4.0	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5	3.5	4.0	4.5	3.0	3.5

gebruik *training data* voor voorspellen

Evaluatie (training)

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5	3.5	3.5	4.0	3.5	3.0	4.5
105				4.5	3.5	5.0	5.0	4.2
177	5.0	3.7	3.5	3.0	3.6	4.5	4.0	2.5
182	4.0			5.0	4.0	4.0	4.1	4.5
232	3.5	4.0	4.0			4.5		3.5
249	4.0		4.0		5.0	5.0	4.0	3.5
274	4.0		3.5	4.5	4.0	4.0	4.0	4.5
288	4.5		2.0		5.0	4.0	3.5	4.0
298	2.0		0.5	4.0	3.1	4.0	4.0	3.5
307	4.0		2.5	4.5	3.6	3.5	4.0	3.5

voorspelde ratings (KNN)

Evaluatie

$r_{i,u}$ $p_{i,u}$

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5 3.5	3.5		4.0 3.5	3.0	4.5	2.5 3.6
105			4.5	3.5	5.0	5.0 4.2		3.5
177	5.0 3.7	3.5	3.0 3.6		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0 4.1	4.5	3.0	3.5
232	3.5 4.0	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0 4.0	3.5 4.0			5.0 3.6
298	2.0	0.5	4.0 3.1	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5 3.6	3.5	4.0	4.5	3.0	3.5

Evaluatie

 $r_{i,u} - p_{i,u}$

movieId	1	2	16	32	47	50	104	110
userId								
68					2.5 - 3.5	4.0 - 3.5		2.5 - 3.6
105						5.0 - 4.2		
177		5.0 - 3.7		3.0 - 3.6				
182					4.0 - 4.1			
232		3.5 - 4.0						
249								
274								
288					5.0 - 4.0	3.5 - 4.0		5.0 - 3.6
298				4.0 - 3.1				
307				4.5 - 3.6				

Evaluatie

$$r_{i,u} - p_{i,u}$$

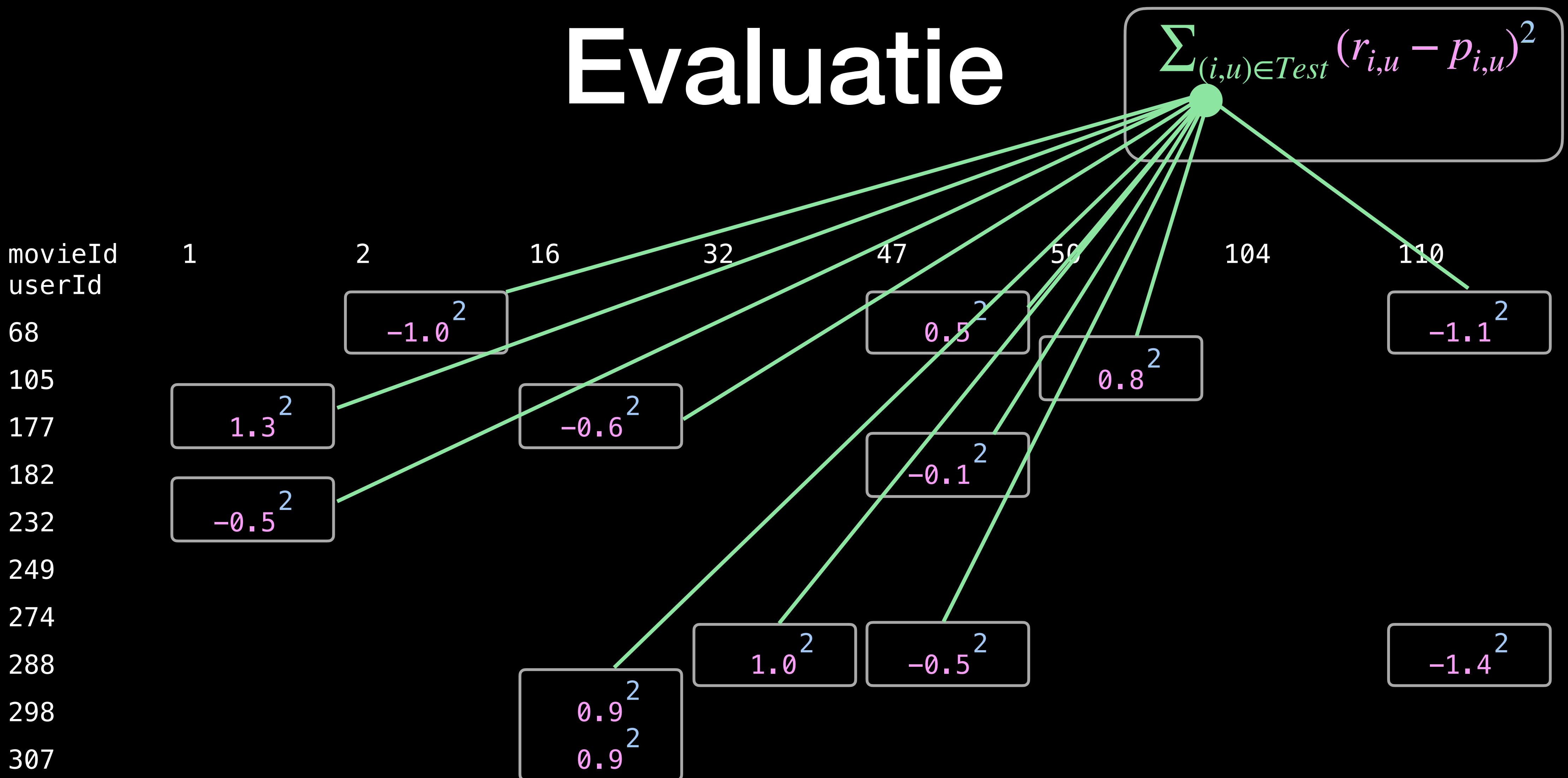
movieId	1	2	16	32	47	50	104	110
userId								
68			-1.0		0.5			-1.1
105						0.8		
177	1.3			-0.6				
182					-0.1			
232		-0.5						
249								
274								
288					1.0	-0.5		-1.4
298				0.9				
307				0.9				

Evaluatie

$$(r_{i,u} - p_{i,u})^2$$

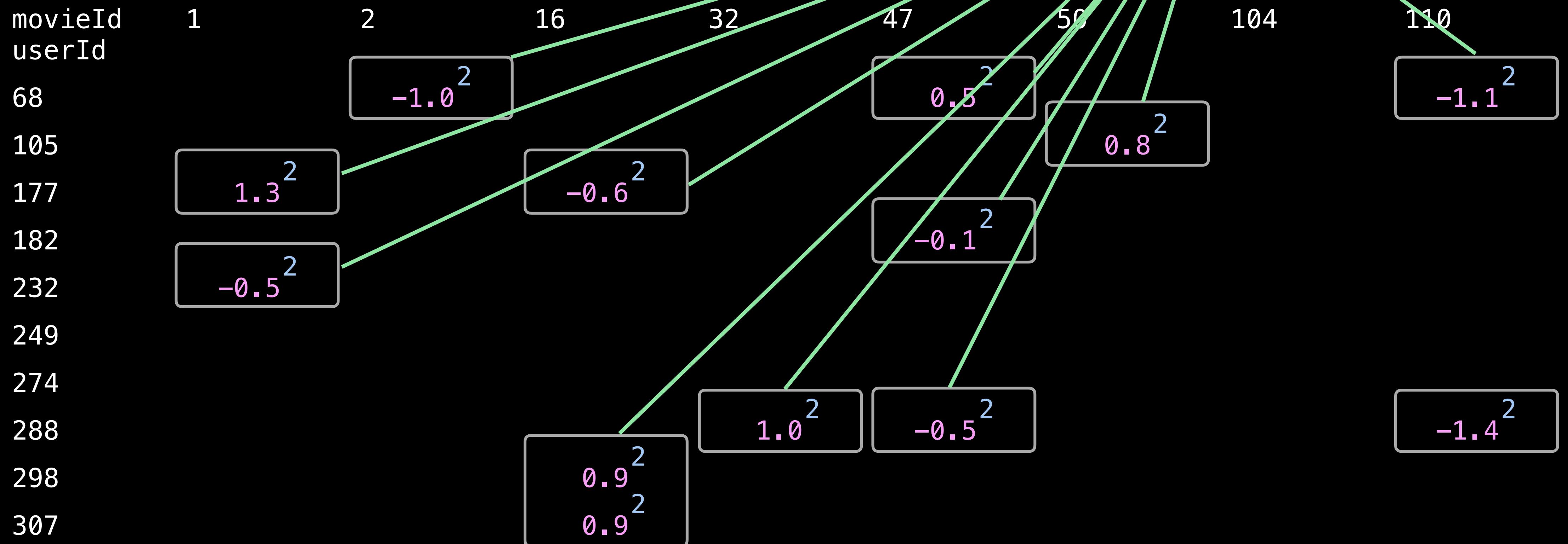
movieId	1	2	16	32	47	50	104	110
userId								
68					-1.0^2	0.5^2		-1.1^2
105		1.3^2		-0.6^2		0.8^2		
177						-0.1^2		
182								
232		-0.5^2						
249								
274								
288				0.9^2	1.0^2	-0.5^2		-1.4^2
298				0.9^2				
307				0.9^2				

Evaluatie



Evaluatie

$$\frac{\sum_{(i,u) \in Test} (r_{i,u} - p_{i,u})^2}{|Test|}$$

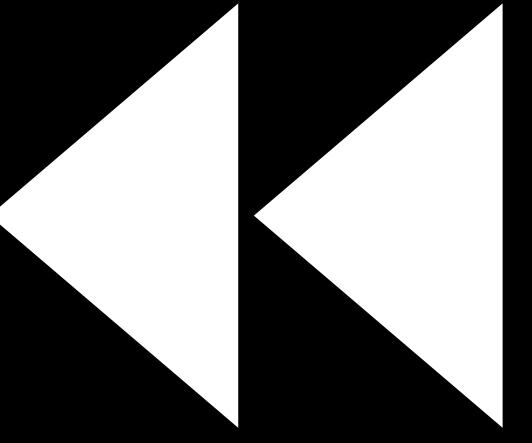


Evaluatie

$$\frac{\sum_{(i,u) \in Test} (r_{i,u} - p_{i,u})^2}{|Test|}$$

movieId	1	2	16	32	47	50	104	110
userId								
68					-1.0^2	0.5^2		-1.1^2
105		1.3^2		-0.6^2			0.8^2	
177						-0.1^2		
182								
232		-0.5^2						
249								
274								
288				1.0^2	-0.5^2			-1.4^2
298				0.9^2				
307				0.9^2				

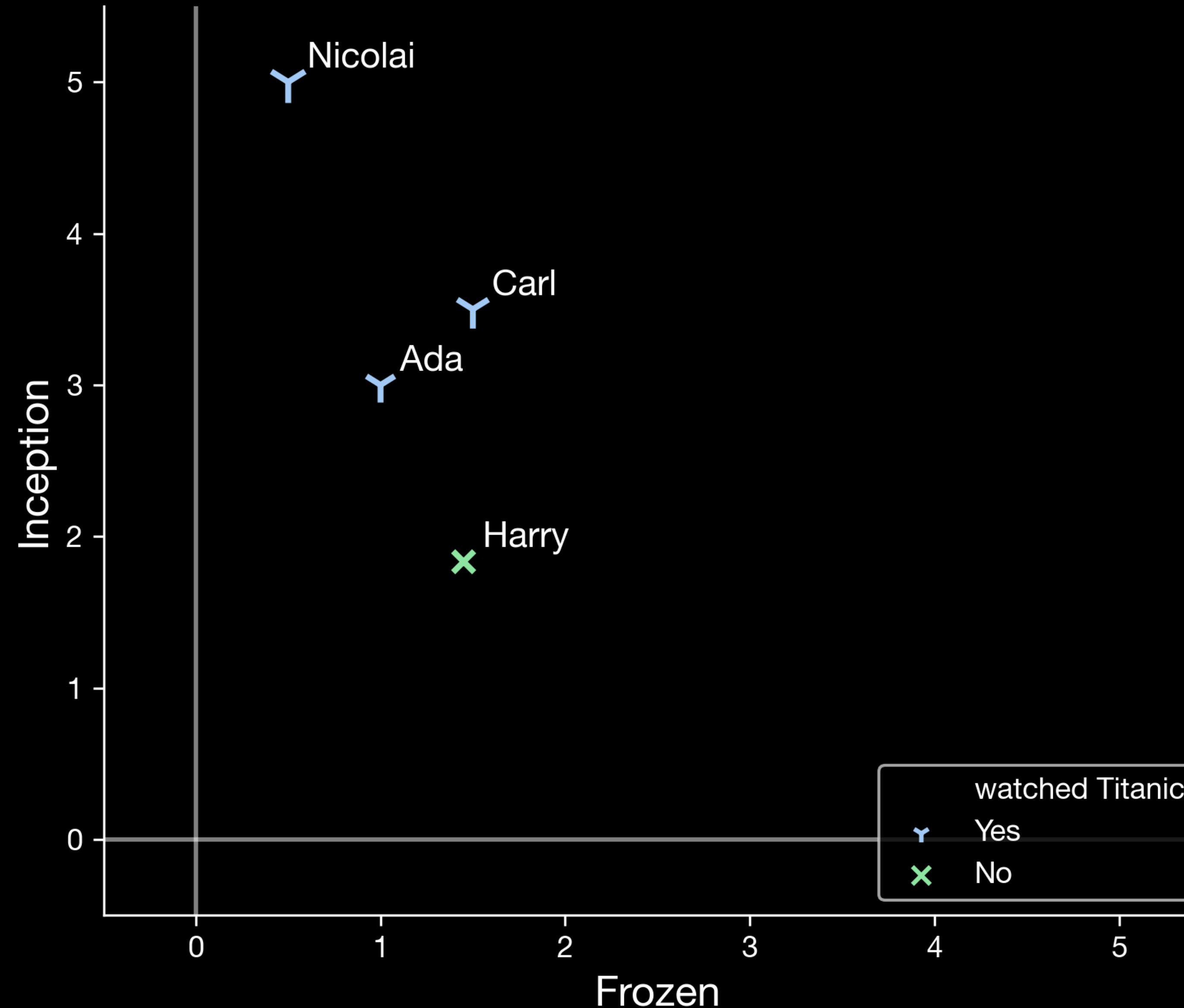
$$MSE = \frac{\sum_{(i,u) \in Test} (r_{i,u} - p_{i,u})^2}{|Test|}$$



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KNN

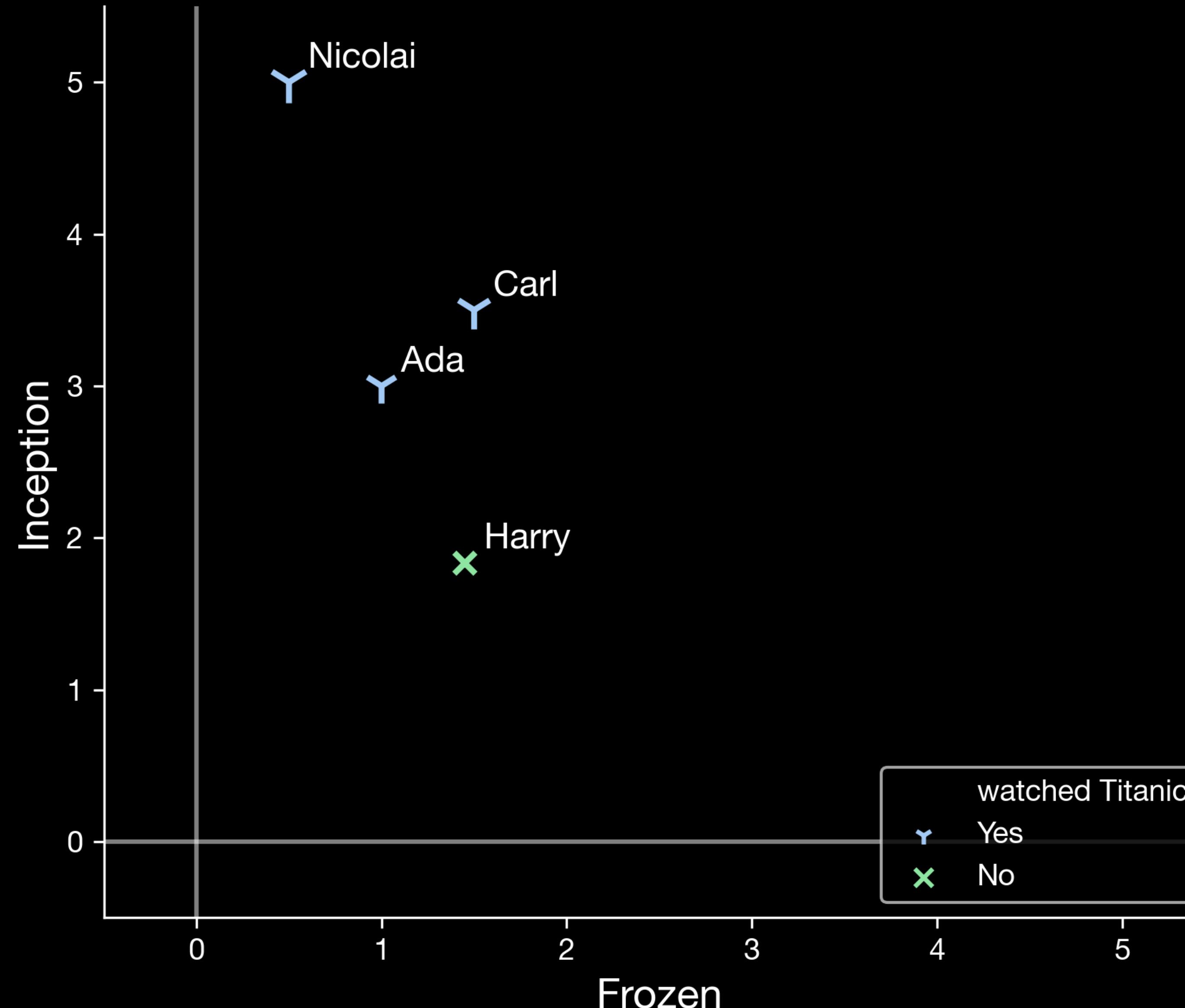
voorspelling van ratings



	Frozen	Inception	Titanic
Ada	1.00	3.00	3.00
Carl	1.50	3.50	4.00
Gotlob	?	5.00	4.00
Harry	1.45	1.83	?
Nicolai	0.50	5.00	5.00
Leo	2.50	2.00	3.00
Laura	?	3.50	4.00
Maurits	4.50	?	?
Marion	5.00	4.20	?
Carlo	4.50	?	4.00
...			

KNN

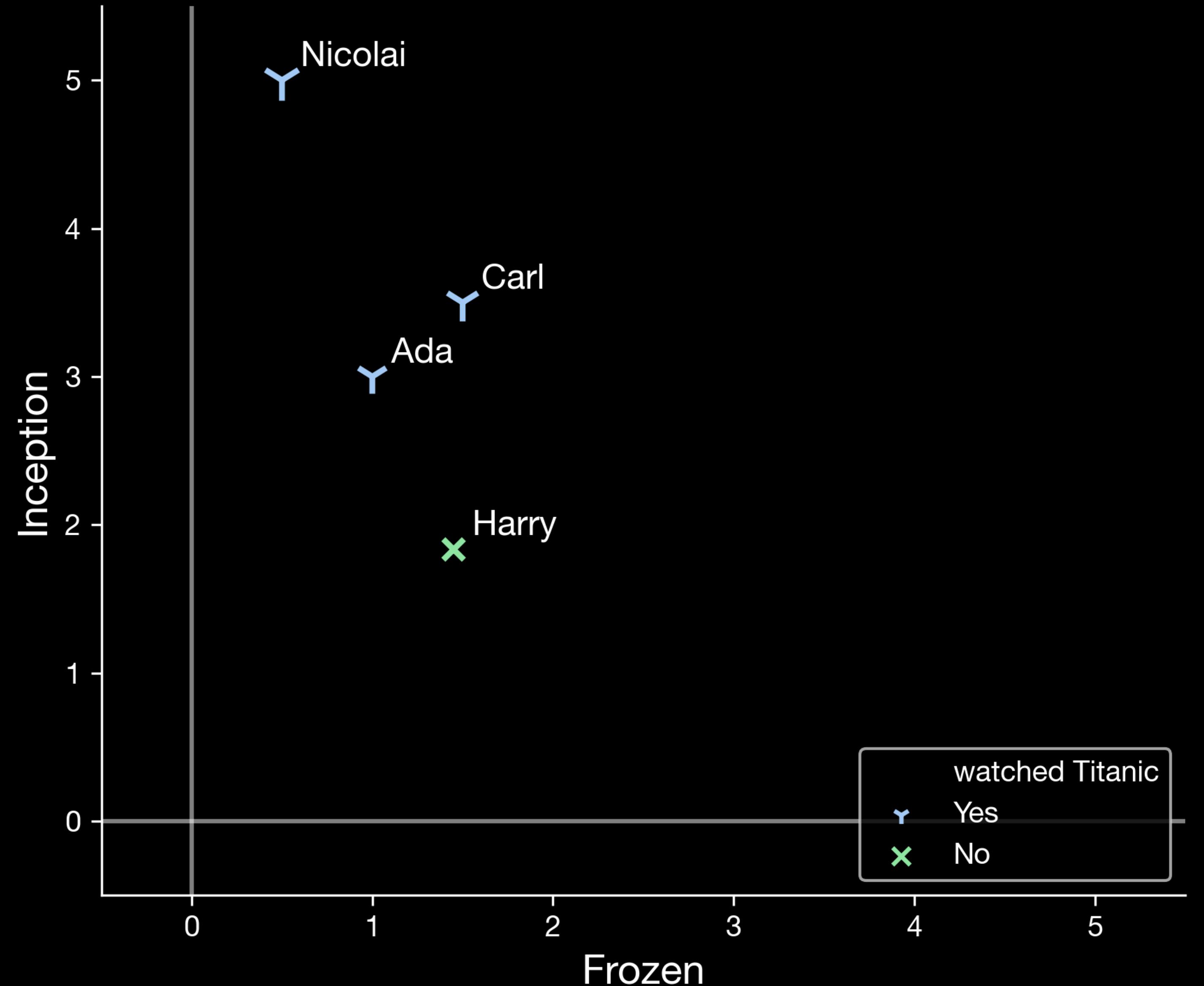
voorspelling van ratings



	Frozen	Inception	Titanic
Ada	1.00	3.00	3.00
Carl	1.50	3.50	4.00
Gotlob	1.84	5.00	4.00
Harry	1.45	1.83	2.09
Nicolai	0.50	5.00	5.00
Leo	2.50	2.00	3.00
Laura	4.10	3.50	4.00
Maurits	4.50	3.64	4.52
Marion	5.00	4.20	4.06
Carlo	4.50	3.01	4.00
...			

KNN

**voorspelling van
aanbevelingen**



Frozen Inception Titanic

Character	Frozen	Inception	Titanic
Ada	1.0	3.0	Yes
Carl	1.3	3.5	Yes
Gotlob	4.0	1.2	No
Harry	1.3	1.9	No
Nicolai	0.5	4.9	Yes
Leo	4.0	0.0	Yes
Laura	4.0	0.2	Yes
Maurits	4.0	-0.2	Yes
Marion	4.0	0.5	Yes
Carlo	4.0	-0.8	No
...

Threshold: prediction > 3.5?

Evaluatie (regressie)

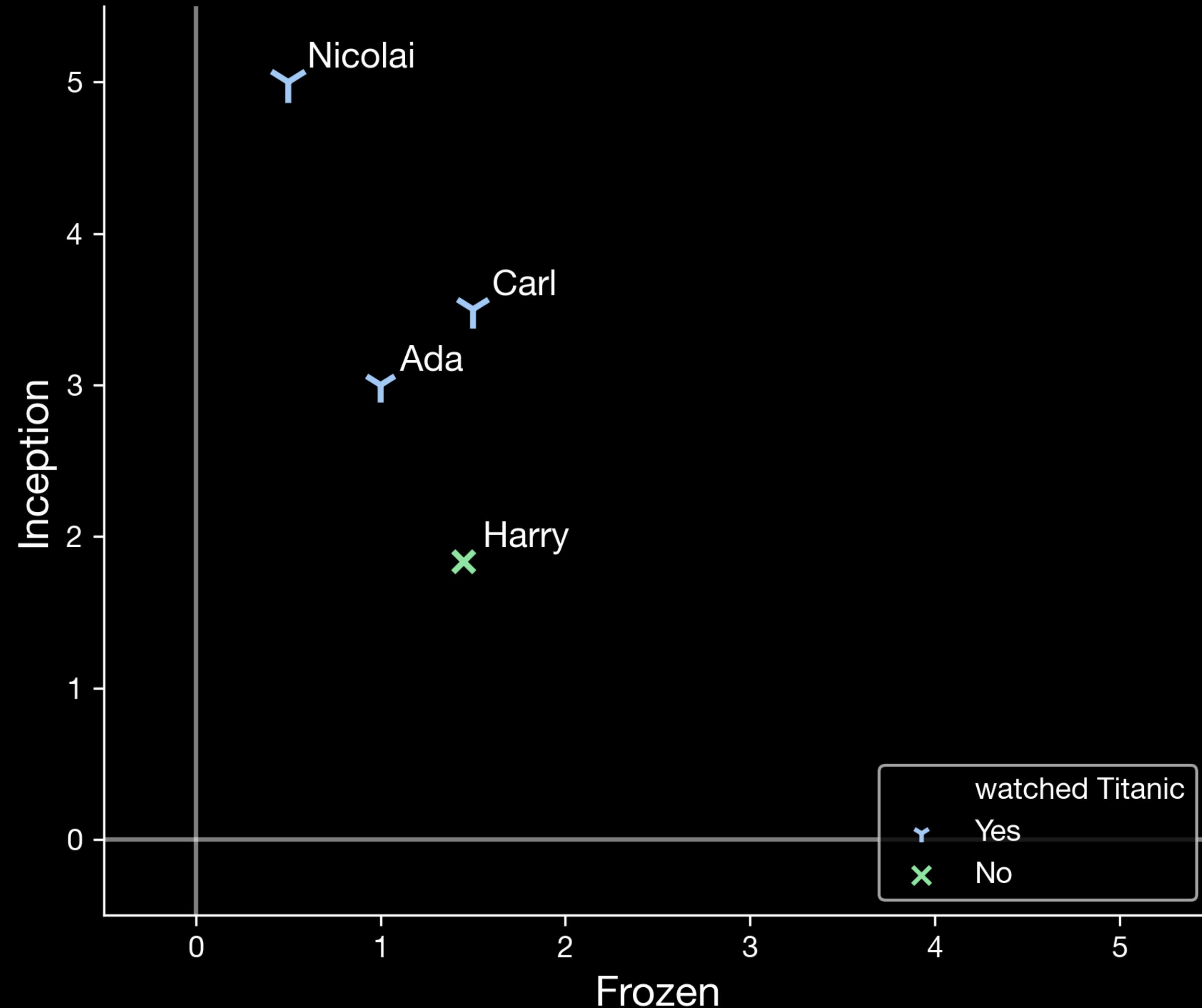
Evaluatie (classificatie)

$$Precision = \frac{TP}{TP + FP}$$

$$Recall = \frac{TP}{TP + FN}$$

Evaluatie

zijn dit goede
voorspellingen?



	Frozen	Inception	Titanic
Ada	1.00	3.00	3.00
Carl	1.50	3.50	4.00
Gotlob	1.84	5.00	4.00
Harry	1.45	1.83	2.09
Nicolai	0.50	5.00	5.00
Leo	2.50	2.00	3.00
Laura	4.10	3.50	4.00
Maurits	4.50	3.64	4.52
Marion	5.00	4.20	4.06
Carlo	4.50	3.01	4.00
...			

Evaluatie

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5	3.5		4.0	3.0	4.5	2.5
105			4.5	3.5	5.0	5.0		3.5
177	5.0	3.5	3.0		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0	4.5	3.0	3.5
232	3.5	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0	3.5			5.0
298	2.0	0.5	4.0	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5	3.5	4.0	4.5	3.0	3.5

Evaluatie

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5	3.5		4.0	3.0	4.5	2.5
105			4.5	3.5	5.0	5.0		3.5
177	5.0	3.5	3.0		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0	4.5	3.0	3.5
232	3.5	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0	3.5			5.0
298	2.0	0.5	4.0	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5	3.5	4.0	4.5	3.0	3.5

Evaluatie (test data)

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5	3.5		4.0	3.0	4.5	2.5
105			4.5	3.5	5.0	5.0		3.5
177	5.0	3.5	3.0		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0	4.5	3.0	3.5
232	3.5	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0	3.5			5.0
298	2.0	0.5	4.0	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5	3.5	4.0	4.5	3.0	3.5

Evaluatie

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5 3.5	3.5		4.0 3.5	3.0	4.5	2.5 3.6
105			4.5	3.5	5.0	5.0 4.2		3.5
177	5.0 3.7	3.5	3.0 3.6		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0 4.1	4.5	3.0	3.5
232	3.5 4.0	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0 4.0	3.5 4.0			5.0 3.6
298	2.0	0.5	4.0 3.1	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5 3.6	3.5	4.0	4.5	3.0	3.5

Evaluatie

Recommend: $p_{u,i} > 3.6$

movieId	1	2	16	32	47	50	104	110
userId								
68	2.5	2.5 3.5	3.5		4.0 3.5	3.0	4.5	2.5 3.6
105			4.5	3.5	5.0	5.0 4.2		3.5
177	5.0 3.7	3.5	3.0 3.6		4.5	4.0	2.5	
182	4.0		5.0	4.0	4.0 4.1	4.5	3.0	3.5
232	3.5 4.0	4.0			4.5		3.5	4.5
249	4.0	4.0		5.0	5.0	4.0	3.5	5.0
274	4.0	3.5	4.5	4.0	4.0	4.0	3.5	4.5
288	4.5	2.0		5.0 4.0	3.5 4.0			5.0 3.6
298	2.0	0.5	4.0 3.1	4.0	4.0	3.5	3.5	3.0
307	4.0	2.5	4.5 3.6	3.5	4.0	4.5	3.0	3.5

Evaluatie

Recommend: $p_{u,i} > 3.6$

movieId	1	2	16	32	47	50	104	110
userId								
68		2.5			4.0			2.5
105		5.0		3.0		5.0		
177								
182		3.5			4.0			
232								
249								
274								
288				4.0	5.0	3.5		5.0
298				4.5				
307								

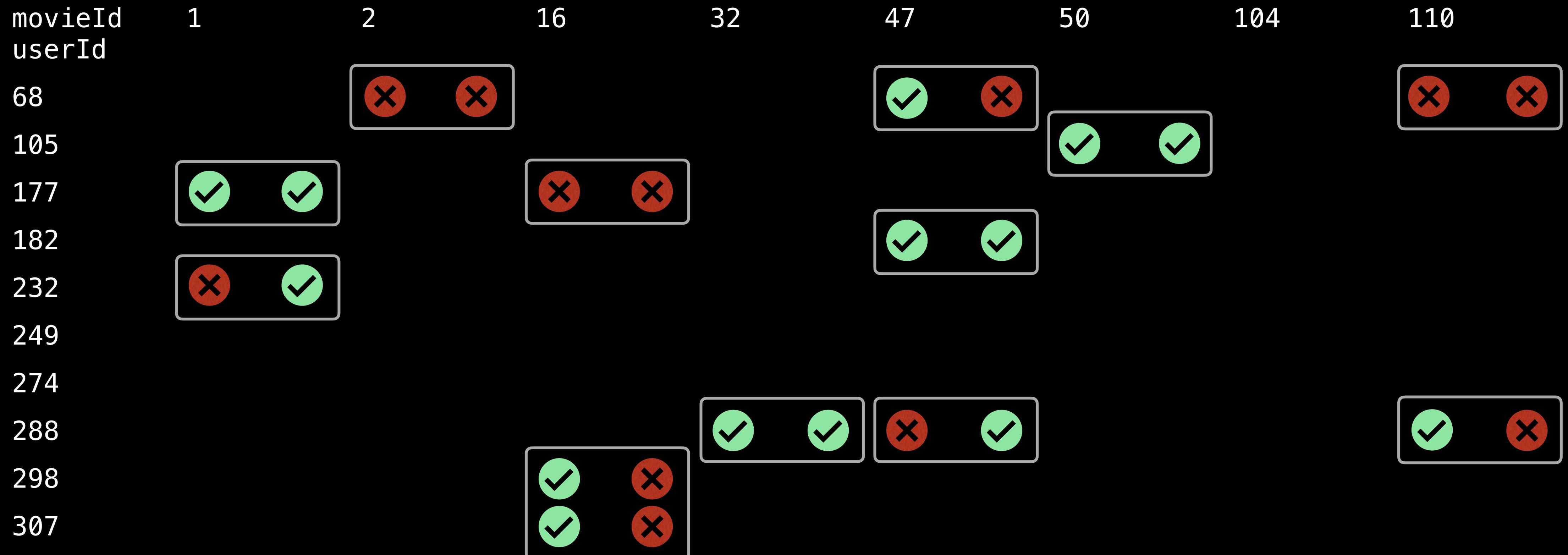
Evaluatie

Used: $r_{u,i} > 3.6$

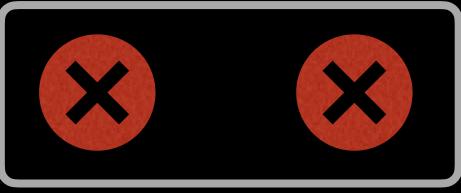
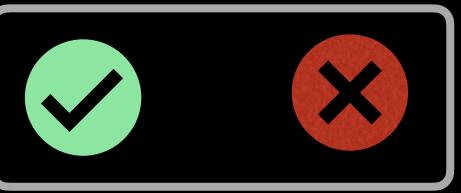
movieId	1	2	16	32	47	50	104	110
userId								
68		2.5			4.0			2.5
105		5.0		3.0		5.0		
177								
182		3.5			4.0			
232								
249								
274								
288				4.0	5.0	3.5		5.0
298				4.5				
307								

Evaluatie

Used: $r_{u,i} > 3.6$



Evaluatie

movieId	1	2	16	32	47	50	104	110
userId		TN			FN	TP		
68								
105								
177								
182								
232								
249		FP						
274					TP	FP		
288								
298								
307					FN			

Precision

$$\text{Precision} = \frac{\text{TP}}{\text{TP} + \text{FP}}$$

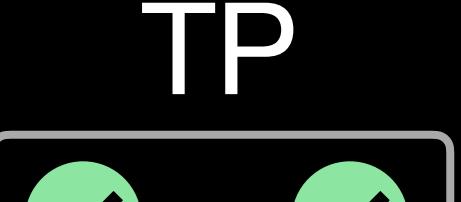
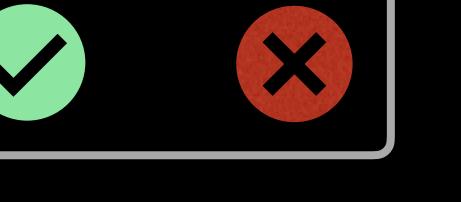
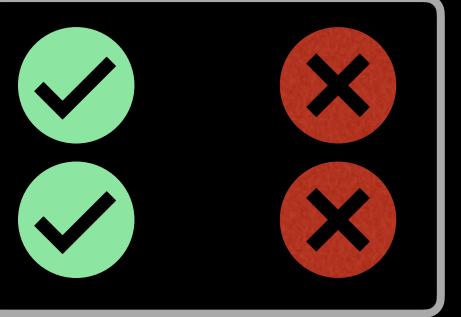

movieId	1	2	16	32	47	50	104	110
userId		TN			FN	TP		
68								
105	TP					TP		
177								
182								
232								
249	FP							
274								
288			FN		TP	FP		FN
298								
307								

Legend: Green checkmark (✓) represents a True Positive (TP). Red cross (✗) represents a False Positive (FP), False Negative (FN), or True Negative (TN).

- Row 1: movieId 1, userId 68: TP (green checkmark, green checkmark)
- Row 1: movieId 2, userId 68: TN (red cross, red cross)
- Row 2: movieId 1, userId 105: TP (green checkmark, green checkmark)
- Row 2: movieId 16, userId 105: TN (red cross, red cross)
- Row 3: movieId 47, userId 68: FN (green checkmark, red cross)
- Row 4: movieId 50, userId 105: TP (green checkmark, green checkmark)
- Row 5: movieId 110, userId 68: TN (red cross, red cross)
- Row 6: movieId 232, userId 105: FP (red cross, green checkmark)
- Row 7: movieId 288, userId 232: FN (green checkmark, red cross)
- Row 8: movieId 288, userId 288: FN (green checkmark, red cross)
- Row 9: movieId 288, userId 298: TP (green checkmark, green checkmark)
- Row 10: movieId 298, userId 288: FP (red cross, green checkmark)
- Row 11: movieId 307, userId 298: FN (green checkmark, red cross)

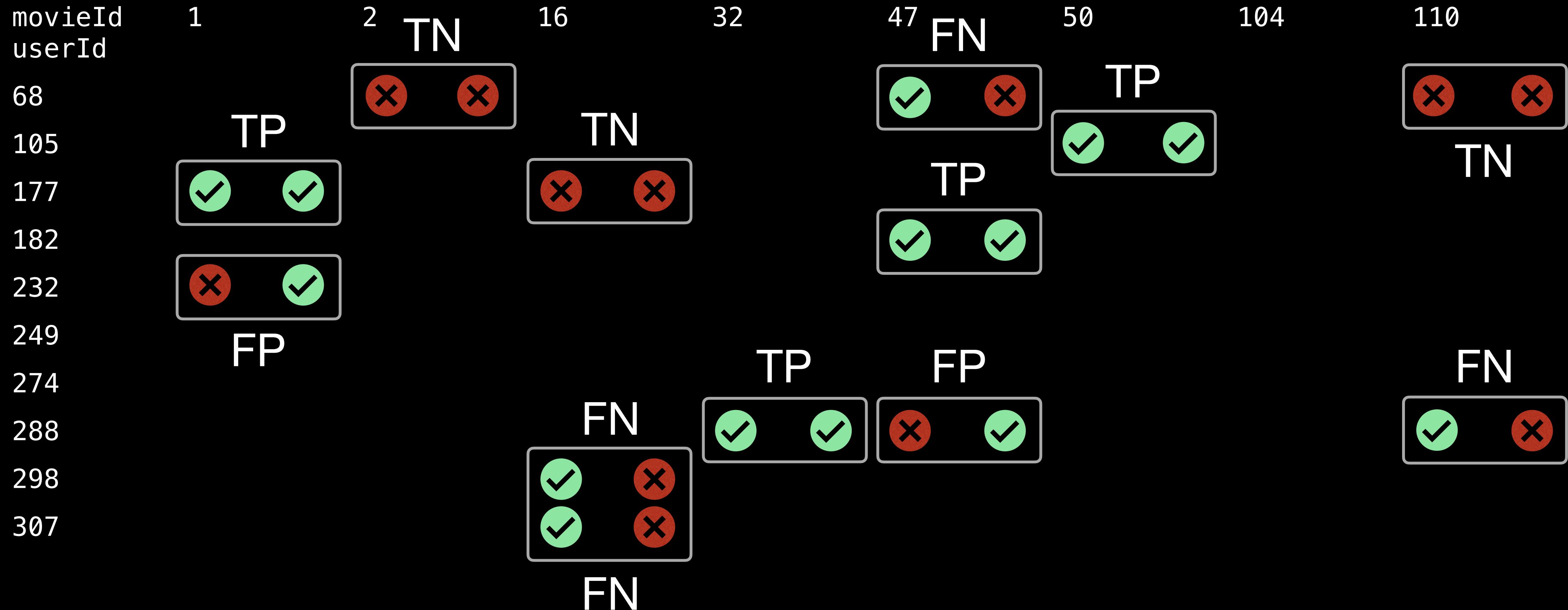
Precision

$$= \frac{4}{4 + 2}$$

movieId	1	2	16	32	47	50	104	110
userId		TN			FN	TP		
68								
105								
177								
182								
232								
249		FP						
274								
288								
298								
307								

Precision

$$= \frac{4}{6} = 0.667$$



$$Precision = \frac{TP}{TP + FP}$$

$$Recall = \frac{TP}{TP + FN}$$

Recall

$$= \frac{\text{TP}}{\text{TP} + \text{FN}}$$

movieId	1	2	16	32	47	50	104	110
userId		TN			FN	TP		
68								
105	TP					TP		
177								
182								
232								
249	FP							
274					TP	FP		
288			FN					
298								
307								
					FN			

Recall

$$= \underline{\hspace{10em}}$$
$$4 + 4$$

movieId

userId

68

105

177

182

232

249

274

288

298

307

1

2

16

32

47

50

104

110

TP

TN

FP

FN

TP

TN

TP

TP

TP

FP

FN

TP

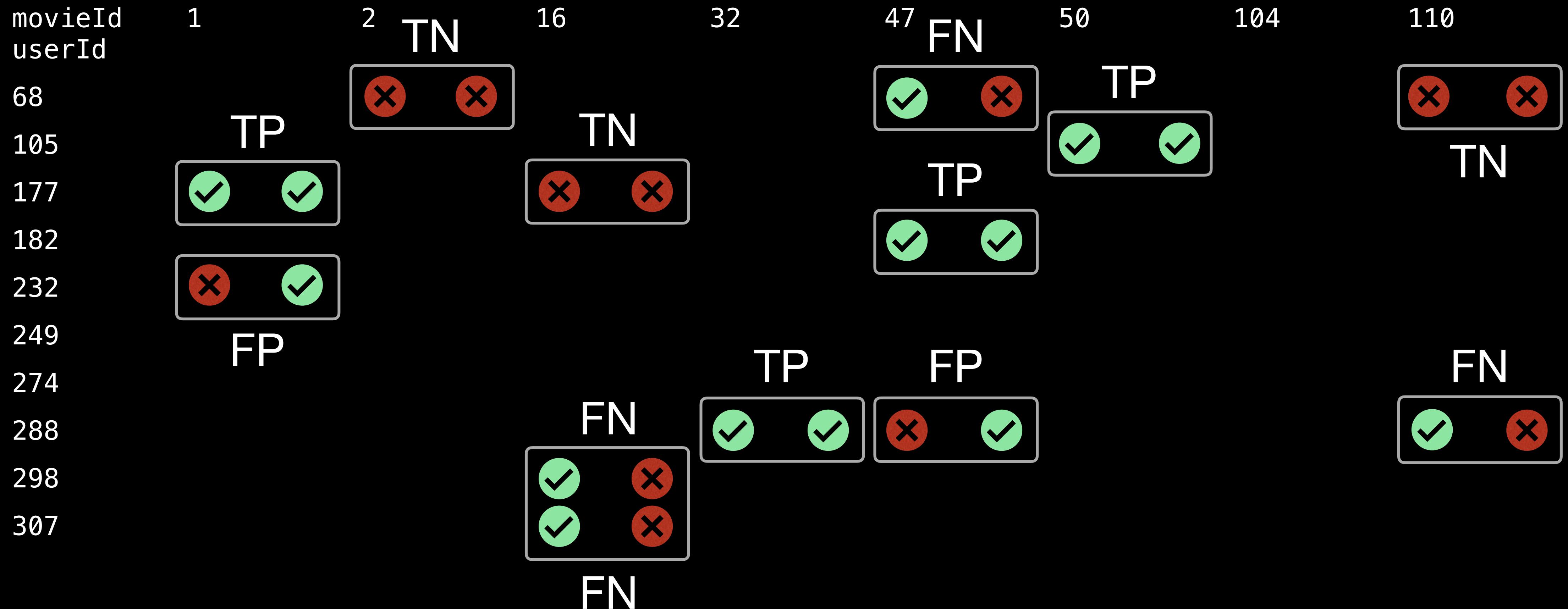
FP

FN

FN

Recall

$$= \frac{4}{8} = 0.5$$



$$Precision = \frac{TP}{TP + FP}$$

$$Recall = \frac{TP}{TP + FN}$$

Precision

Recommend: $p_{u,i} > 3.6$

movieId	1	2	16	32	47	50	104	110
userId								
68		✖ 3.5			✓ 3.5			✖ 3.6
105		✓ 3.7			✖ 3.6			
177								
182		✖ 4.0			✓ 4.1			
232								
249								
274								
288					✓ 4.0	✖ 4.0		✓ 3.6
298					✓ 3.1			
307					✓ 3.6			

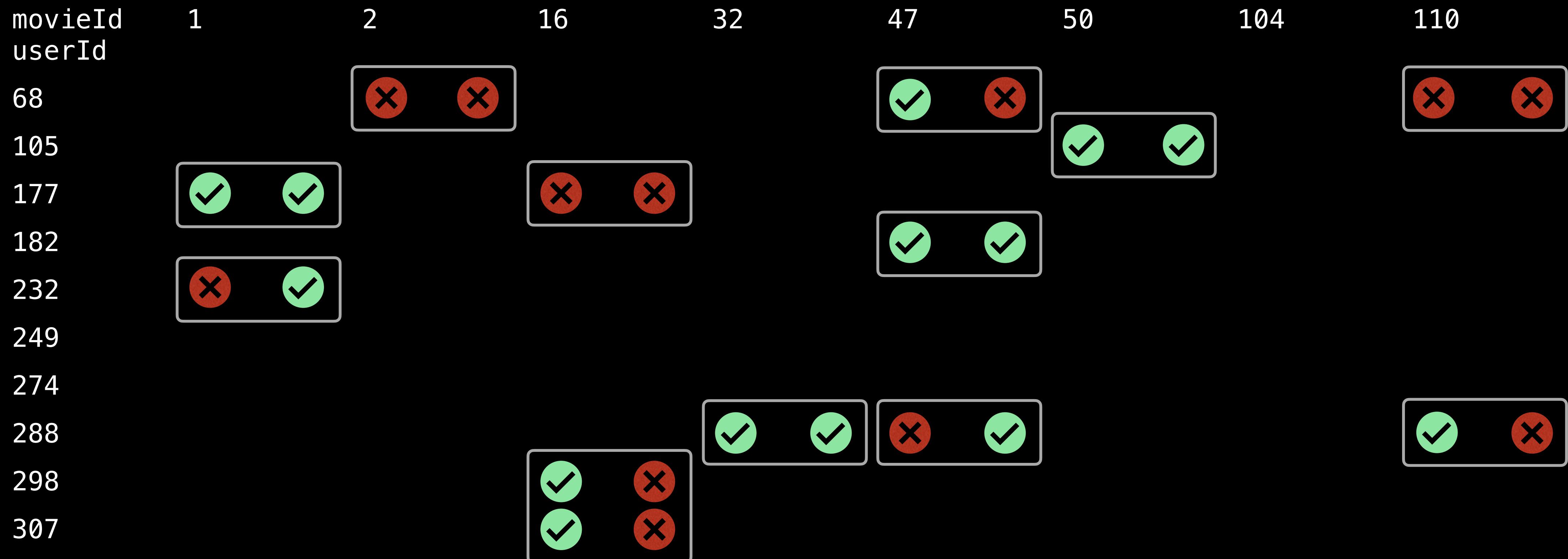
Precision

Recommend: $p_{u,i} > 4.0$

movieId	1	2	16	32	47	50	104	110
userId								
68		✖ 3.5			✓ 3.5			✖ 3.6
105		✓ 3.7			✖ 3.6			
177								
182		✖ 4.0			✓ 4.1			
232								
249								
274								
288					✓ 4.0	✖ 4.0		✓ 3.6
298				✓ 3.1				
307				✓ 3.6				

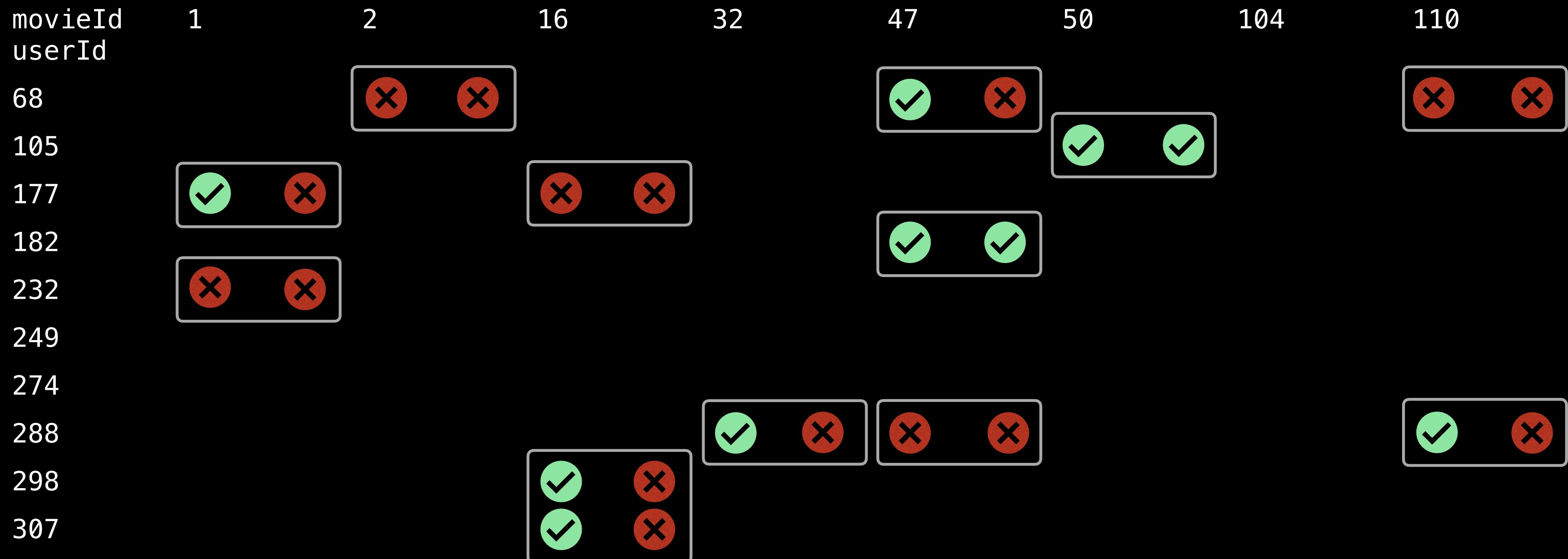
Precision

Recommend: $p_{u,i} > 4.0$

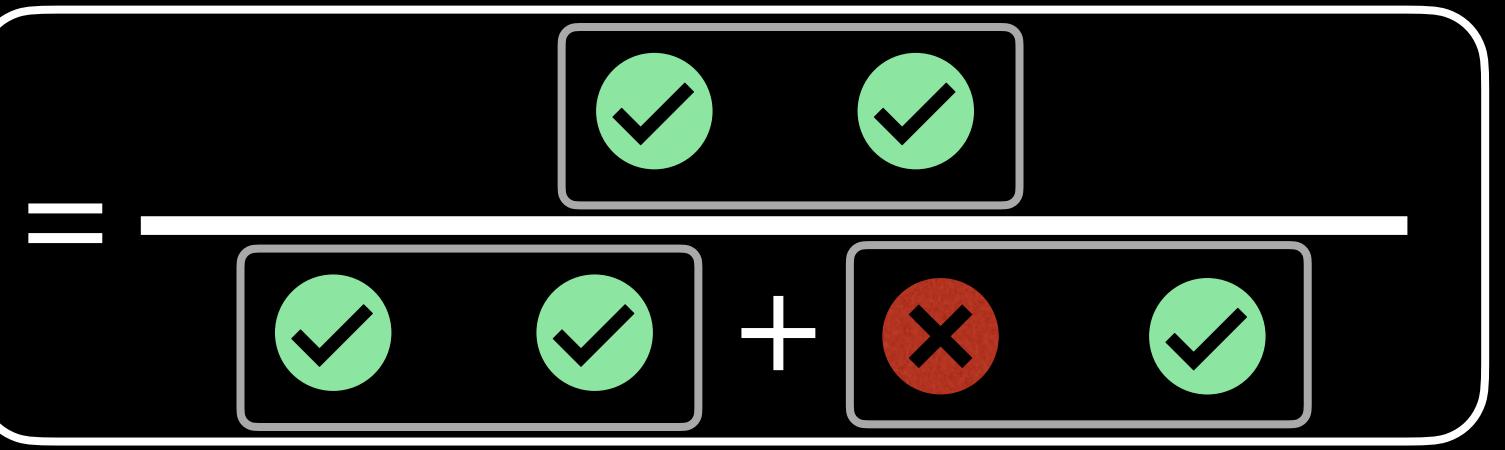


Precision

Recommend: $p_{u,i} > 4.0$



Precision

$$= \frac{\text{True Positives}}{\text{True Positives} + \text{False Positives}}$$


The diagram illustrates the formula for precision. It shows a fraction where the numerator is a box containing two green checkmarks, and the denominator is the sum of two boxes: one containing two green checkmarks and another containing one red X and one green checkmark.

movieId	1	2	16	32	47	50	104	110
userId								
68								
105								
177		✓ ✗						
182						✓ ✓		
232								
249								
274								
288					✓ ✗	✗ ✗		
298				✓ ✗				
307				✓ ✗				

Precision

$$= \frac{2}{2 + 0}$$

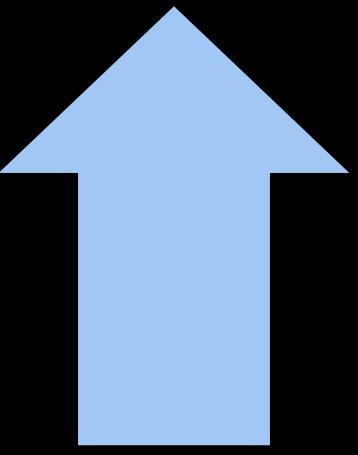
movieId	1	2	16	32	47	50	104	110
userId								
68		✗ ✗			✓ ✗			✗ ✗
105		✓ ✗		✗ ✗		✓ ✓		
177								
182		✗ ✗			✓ ✓			
232								
249								
274								
288					✓ ✗	✗ ✗		✓ ✗
298				✓ ✗	✓ ✗			
307				✓ ✗				

Precision

$$= \frac{2}{2} = 1.0$$

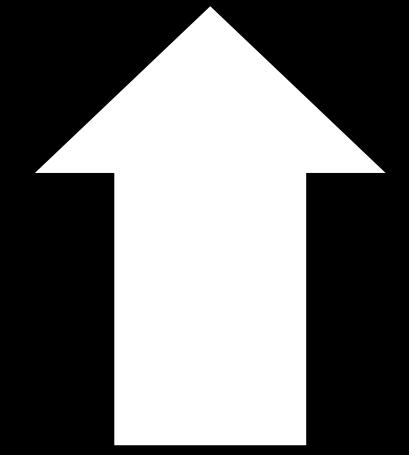
movieId	1	2	16	32	47	50	104	110
userId								
68		✗ ✗			✓ ✗			✗ ✗
105		✓ ✗		✗ ✗		✓ ✓		
177								
182		✗ ✗			✓ ✓			
232								
249								
274								
288					✓ ✗	✗ ✗		✓ ✗
298				✓ ✗	✓ ✗			
307				✓ ✗				

Threshold - Precision

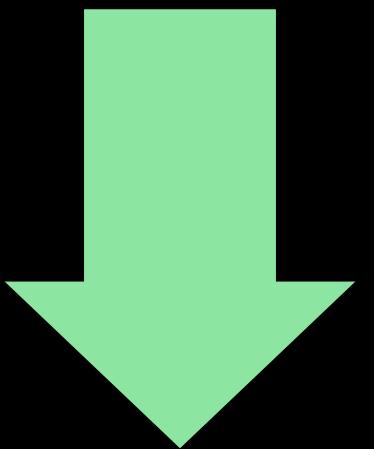


Threshold

Aantal aanbevelingen



Precision



Recall



movieId	1	2	16	32	47	50	104	110
userId								
68					✓ ✗			
105		✓ ✗				✓ ✗		
177			✗ ✗					
182					✓ ✓			
232		✗ ✗						
249								
274								
288				✓ ✗	✗ ✗			✓ ✗
298			✓ ✗	✓ ✗				
307								

Precision

$$= \frac{2}{6 + 2}$$

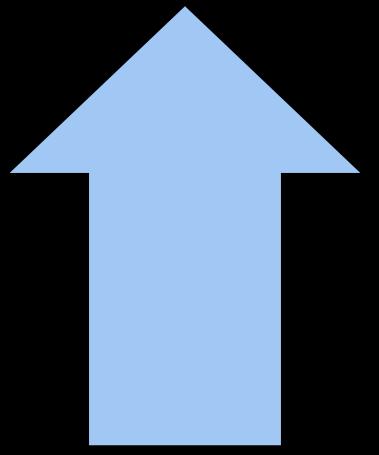
movieId	1	2	16	32	47	50	104	110
userId								
68		✗ ✗			✓ ✗			✗ ✗
105		✓ ✗		✗ ✗		✓ ✓		
177								
182		✗ ✗			✓ ✓			
232								
249								
274								
288					✓ ✗	✗ ✗		✓ ✗
298				✓ ✗	✓ ✗			
307				✓ ✗				

Precision

$$= \frac{2}{8} = 0.25$$

movieId	1	2	16	32	47	50	104	110
userId								
68		✗ ✗			✓ ✗			✗ ✗
105		✓ ✗		✗ ✗		✓ ✓		
177								
182		✗ ✗			✓ ✓			
232								
249								
274								
288					✓ ✗	✗ ✗		✓ ✗
298				✓ ✗	✓ ✗			
307				✓ ✗				

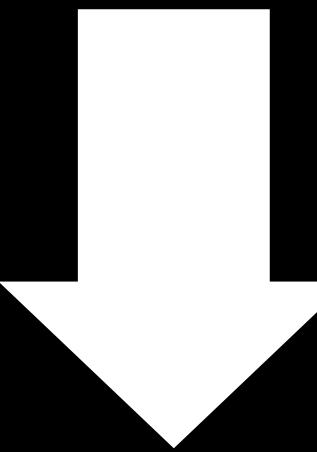
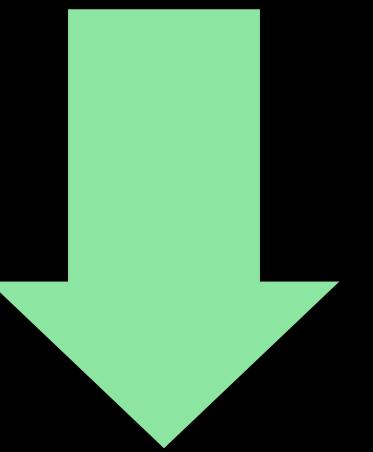
Threshold - Recall



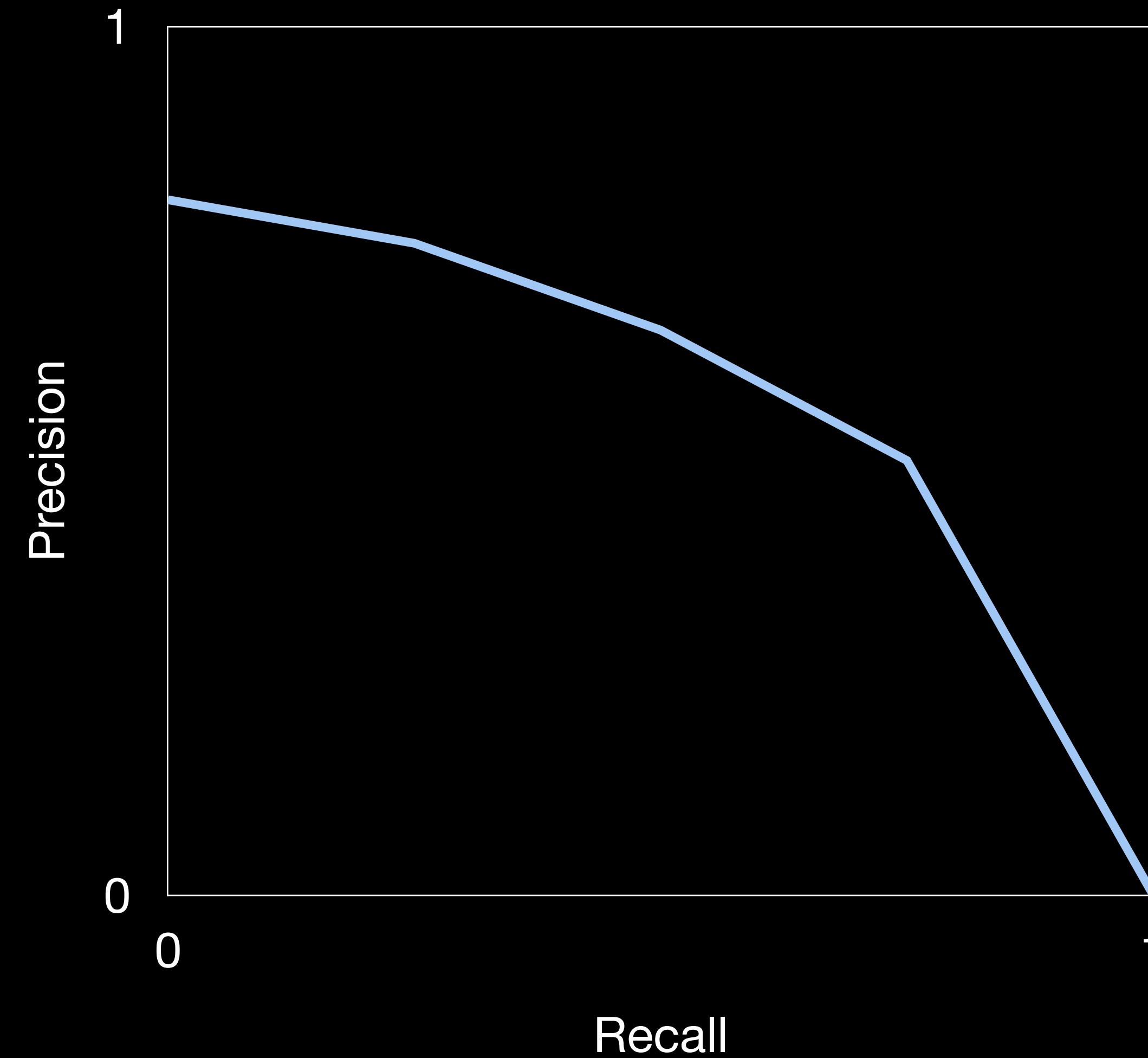
Threshold

Aantal aanbevelingen

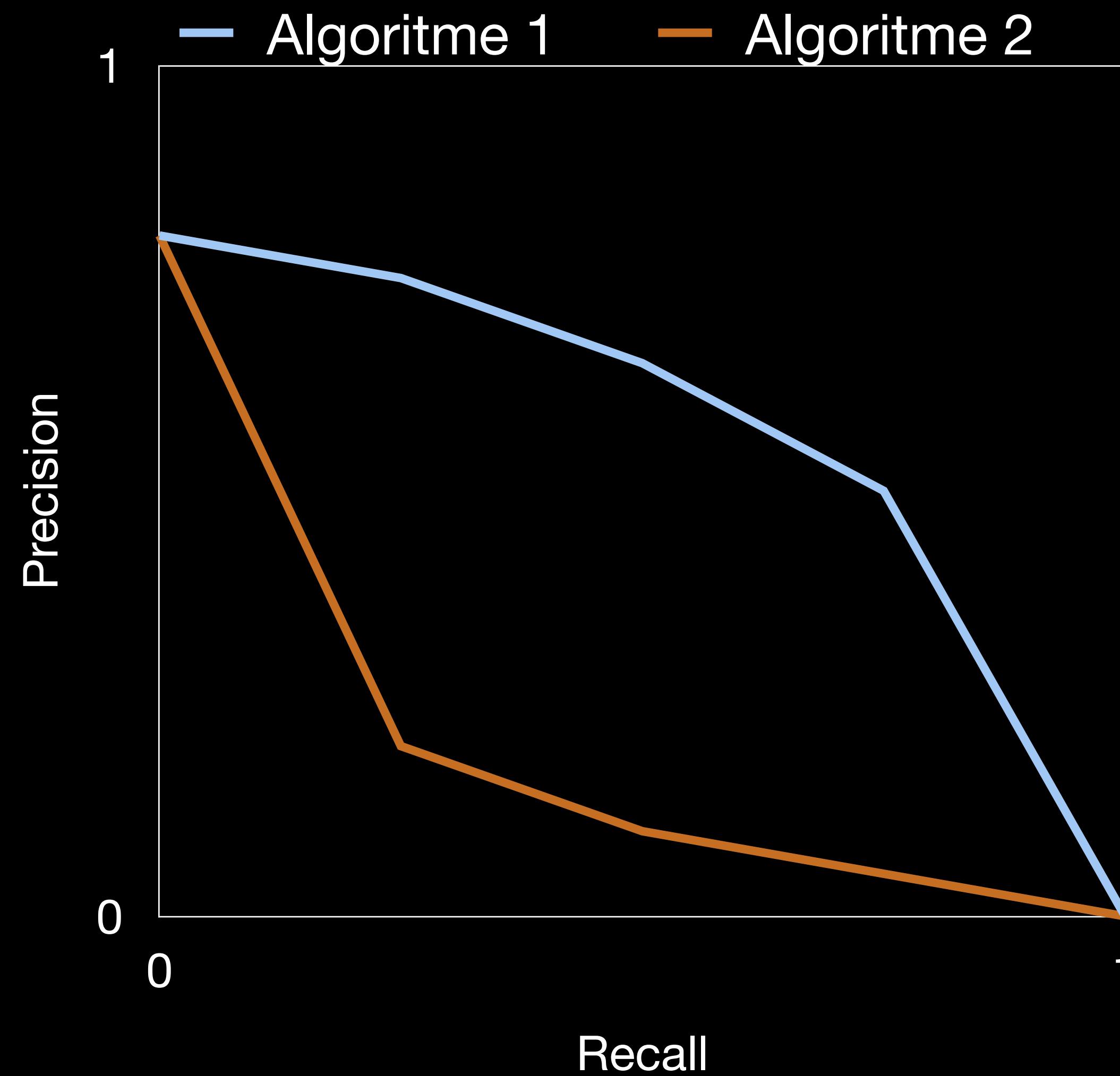
Recall



Precision-recall curve



Precision-recall curve



Regression

$$MSE = \frac{\sum_{(i,u) \in Test} (r_{i,u} - p_{i,u})^2}{|Test|}$$

Classification

$$Precision = \frac{TP}{TP + FP} \quad Recall = \frac{TP}{TP + FN}$$

Doel

Business goal: meer producten verkopen.

Operational goal:

relevance -> producten aanbevelen waar de gebruiker blij mee is

novelty -> nieuw/nog niet eerder gezien

diversity -> gevarieerd aanbod

serendipity -> verassend/ook nooit verwacht

(no bias) -> voorkomen van vooroordelen

(no bubble) -> voorkomen van filter bubbles

...

Doel

Business goal: meer producten verkopen.

Operational goal:

- ✓ *relevance* -> producten aanbevelen waar de gebruiker blij mee is
- ✗ *novelty* -> nieuw/nog niet eerder gezien
- ✗ *diversity* -> gevarieerd aanbod
- ✗ *serendipity* -> verassend/ook nooit verwacht
- ✗ (no bias) -> voorkomen van vooroordelen
- ✗ (no bubble) -> voorkomen van filter bubbles

...

?