Build a Better Netflix, Win a Million Dollars?

Lester Mackey

2012 USA Science and Engineering Festival

NETFLIX

- Rents & streams movies and TV shows
- 100,000 movie titles
- 26 million customers

Recommends “Movies You’ll ♥”

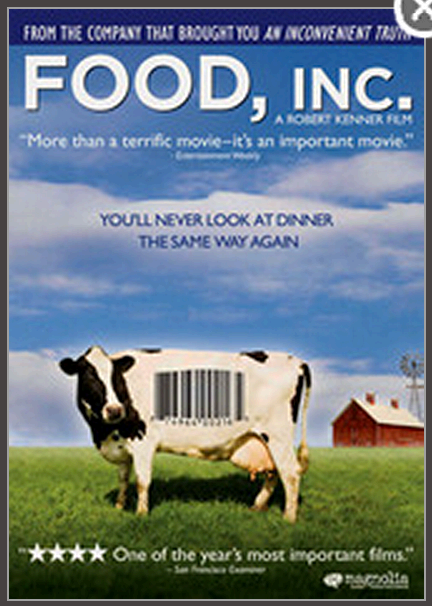
Recommending Movies You'll ♥

NETFLIX | Watch Instantly | Just for Kids | Instant Queue | Suggestions for You | DVDs | LESTER | Movies, TV

Rate what you've seen to discover suggestions for you

Haven't Seen It

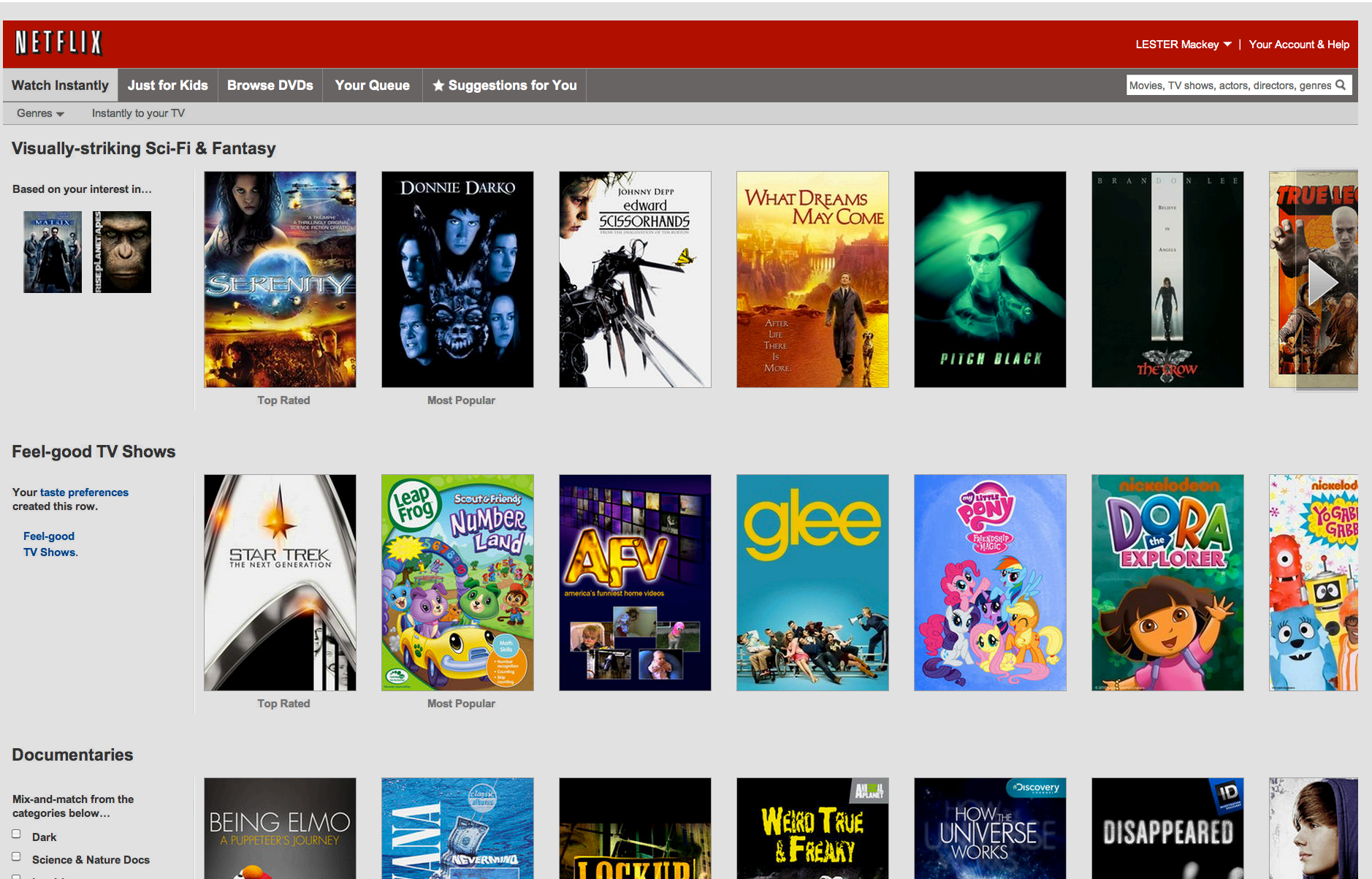
Hated it! Haven't Seen It Loved it!



Haven't Seen It

movies.netflix.com/SetRating?value=4&iw=y&pval=3.9972932&widgetid=M70111470_4706633_3_1&authURL=13...

Recommending Movies You'll ♥



Recommending Movies You'll ♥

Sci-Fi & Fantasy

Add

Not Interested

Incepti

Becaus

Memen

Th

Batma

Inception

2010 **PG-13** **148 minutes**

Dom Cobb earns a tidy sum infiltrating the dreams c
corporate titans to steal their most closely held secre

Starring: Leonardo DiCaprio, Joseph Gordon-Levit

Director: Christopher Nolan

Genre: Sci-Fi & Fantasy

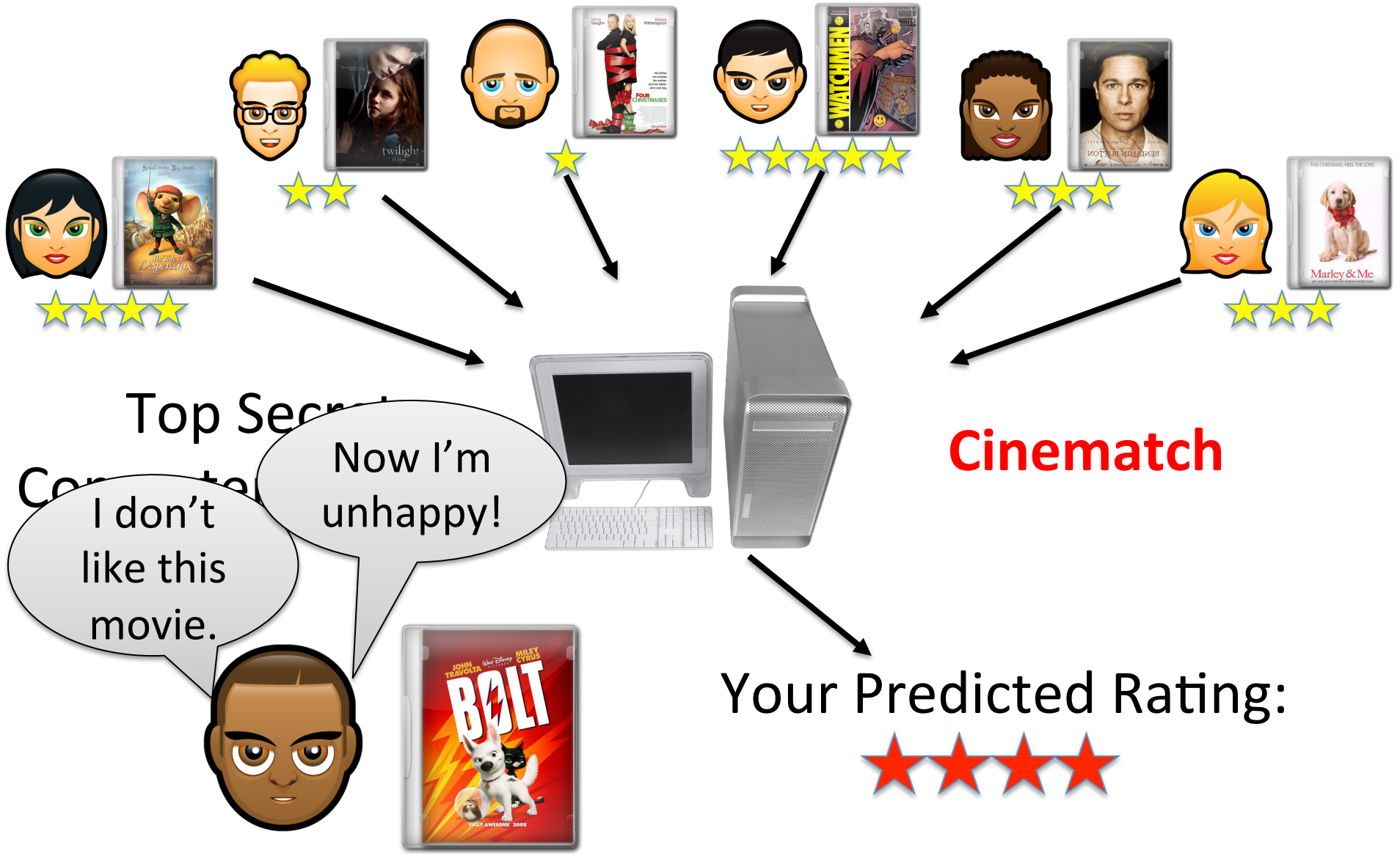
Availability: DVD and Blu-ray

4.4 Our best guess for LESTER

Recommended based on your interest in: *Batman Begins*, *The Matrix* and *Memento*

movies.netflix.com/Movie/Inception/70131314?trkid=4705956

How This Works



Back at Netflix

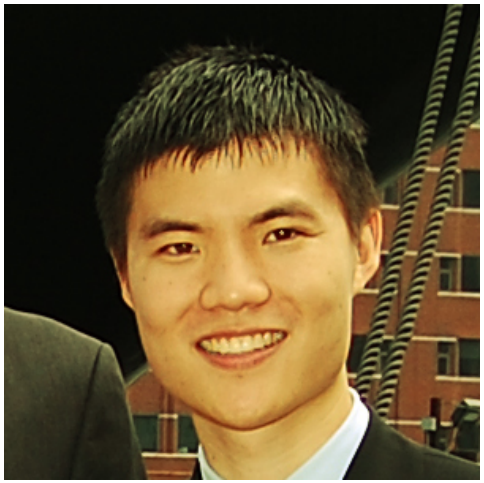
The Netflix Prize

October 2, 2006

- Contest open to the world
- 100 million movie ratings released to public
- **Goal:** Create computer program to predict ratings
- **$1 Million** Grand Prize for beating Cinematch accuracy by 10%
- **$50,000** Progress Prize for the team with the best predictions each year

5,100 teams from 186 countries entered

Dinosaur Planet



David Lin

David Weiss

Lester Mackey

Team Dinosaur Planet

The Ratings

- Training Set
  - What computer programs use to learn customer preferences
  - Each entry: July 5, 1999
  - 100,500,000 ratings in total
  - 480,000 customers and 18,000 movies

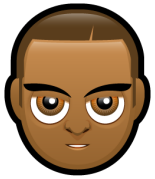
The Ratings: A Closer Look

Highest Rated Movies
The Shawshank Redemption
Lord of the Rings: The Return of the King
Raiders of the Lost Ark
Lord of the Rings: The Two Towers
Finding Nemo
The Green Mile

Most Divisive Movies
Fahrenheit 9/11
Napoleon Dynamite
Pearl Harbor
Miss Congeniality
Lost in Translation
The Royal Tenenbaums

How the Contest Worked

- Quiz Set & Test Set
  - Used to evaluate accuracy of computer programs
  - Each entry:



Rating unknown!

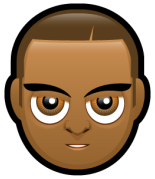
Sept. 9, 2006

- Each team predicts Quiz Set and Test Set ratings once per day
- Netflix displays Quiz score on public Leaderboard

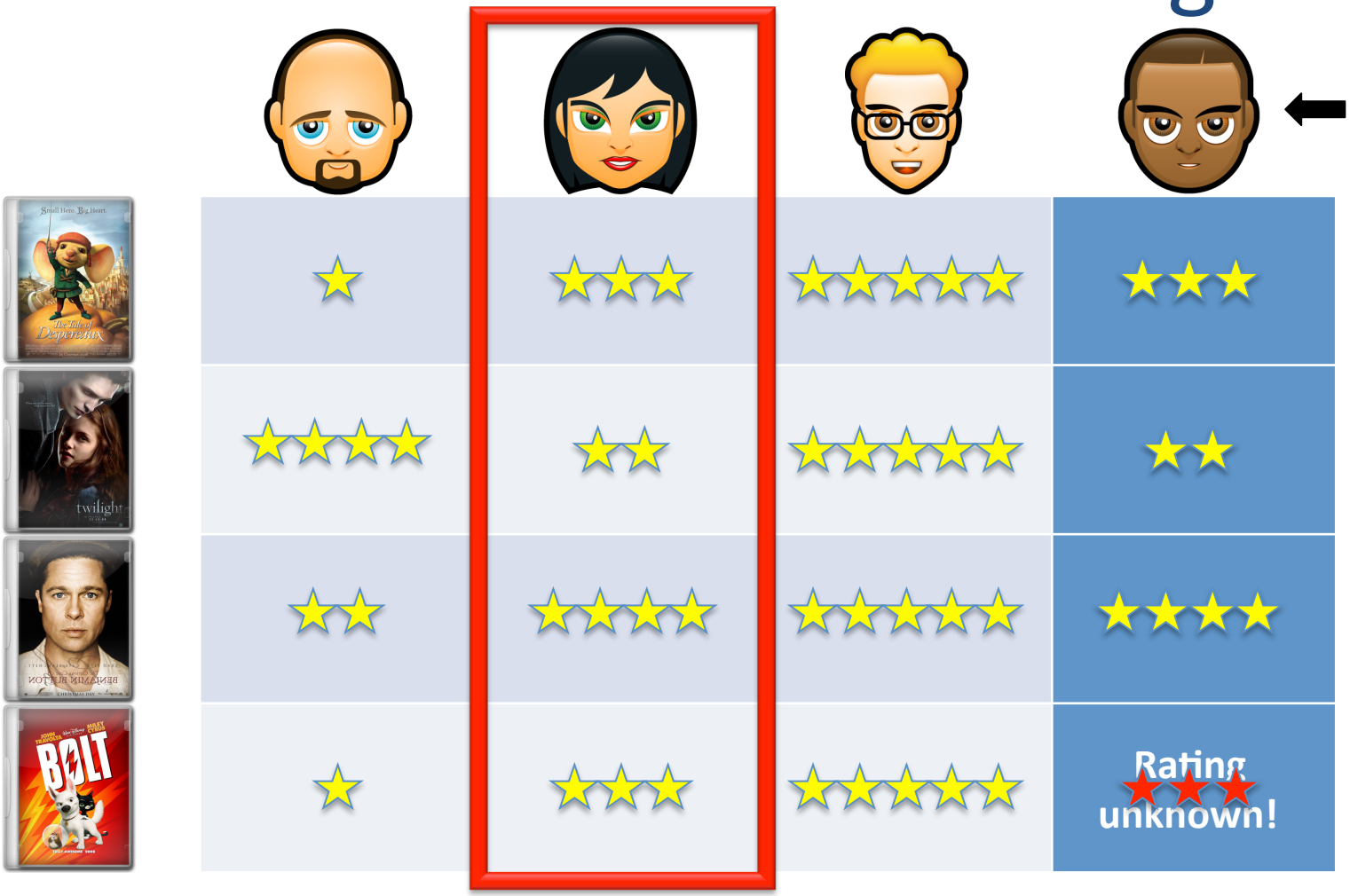
Leaderboard (Week 2)

Team Name	Best Score	% Improvement
No Grand Prize candidates yet	--	--
Grand Prize - RMSE <= 0.8563		
The Thought Gang	0.9413	1.06
Progress Prize 2007 - RMSE <= 0.9419		
wxyzconsulting.com	0.9430	0.88
Sparkling_Destiny	0.9488	0.27
Cinematch score on quiz subset - RMSE = 0.9514		
Baseline0	0.9525	-0.12
CodeMonkey	0.9571	-0.60
Bjornson	0.9648	-1.41
jsnell	0.9670	-1.64

How the Contest Worked

- Quiz Set & Test Set
  - Used to evaluate accuracy of computer programs
  - Each entry:  Rating unknown! Sept. 9, 2006
- Each team predicts Quiz Set and Test Set ratings once per day
- Netflix displays Quiz score on public Leaderboard
- Test score is hidden – but best Test score wins!
  - 10% improvement ➡ **$1 Million Grand Prize**
  - Most improvement in 1 year ➡ **$50,000 Progress Prize**

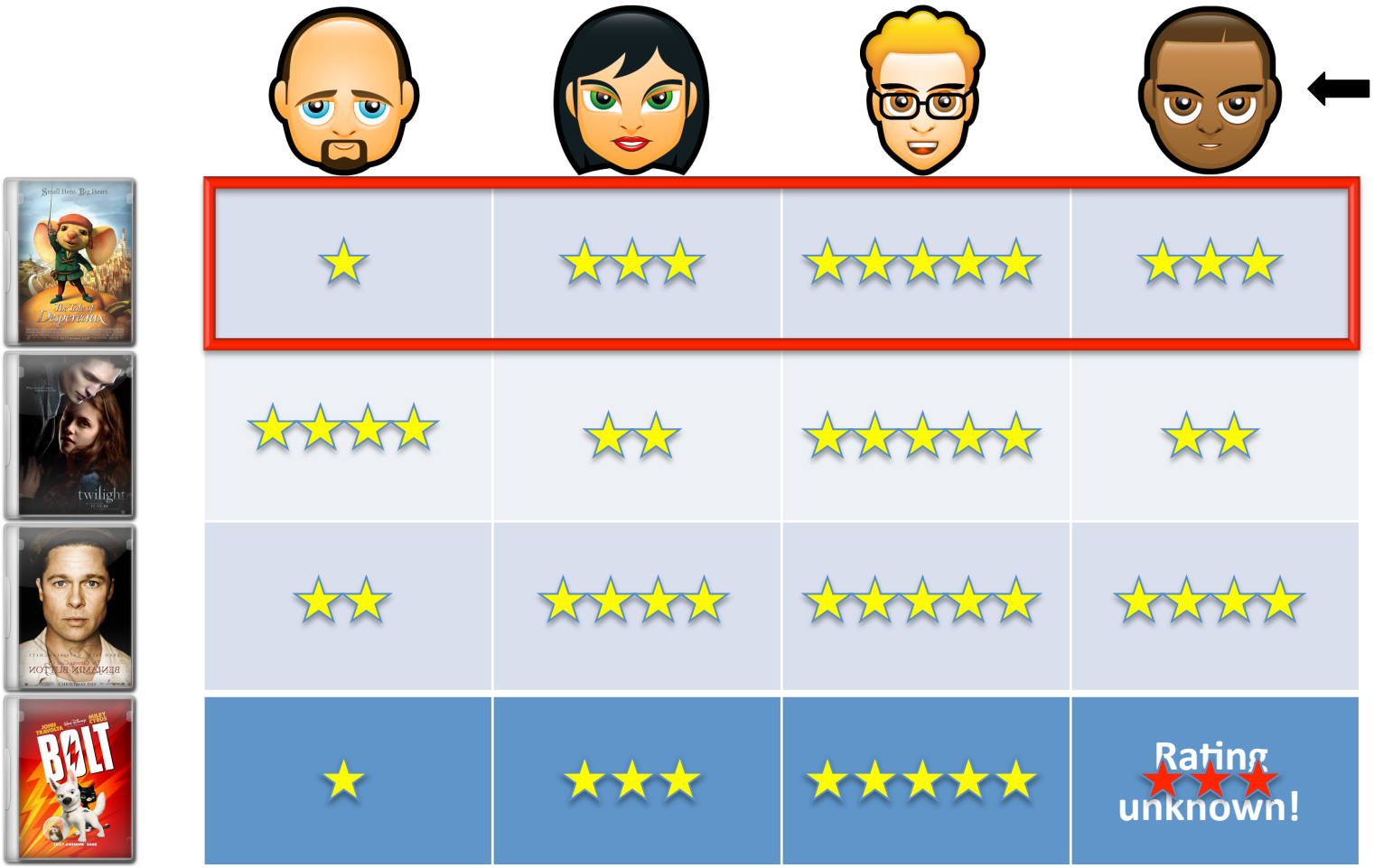
How to Predict Ratings



Nearest Neighbor Rule: 4-5% better than Cinematch

- Find customer with the most similar ratings
- Use her rating as best guess for new guy's rating

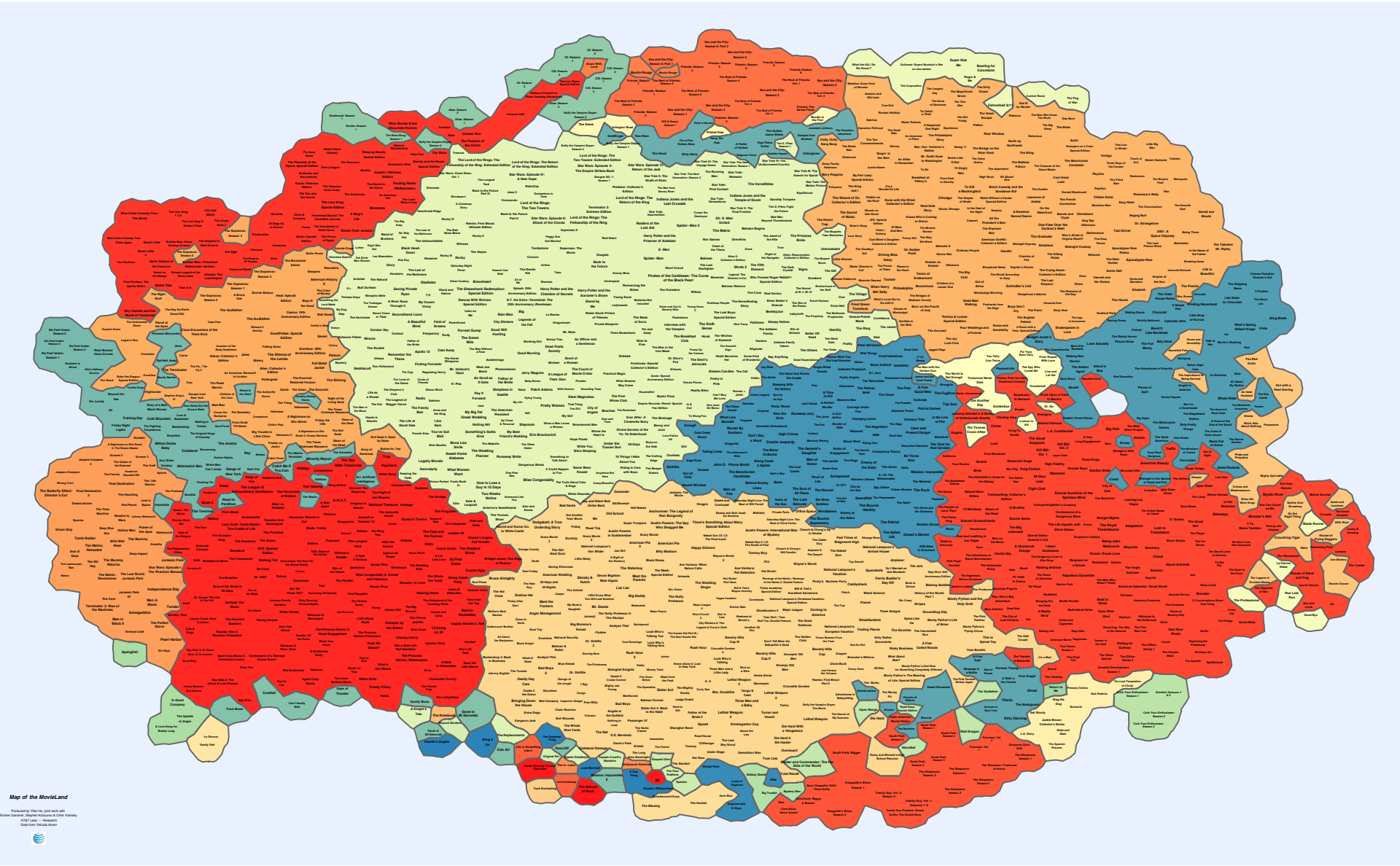
How to Predict Ratings



Nearest Neighbor Rule: 4-5% better than Cinematch

- Find movie with the most similar ratings
- Use its rating as best guess for new guy's rating

Map of Movie Neighbors



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Map of Movie Neighbors

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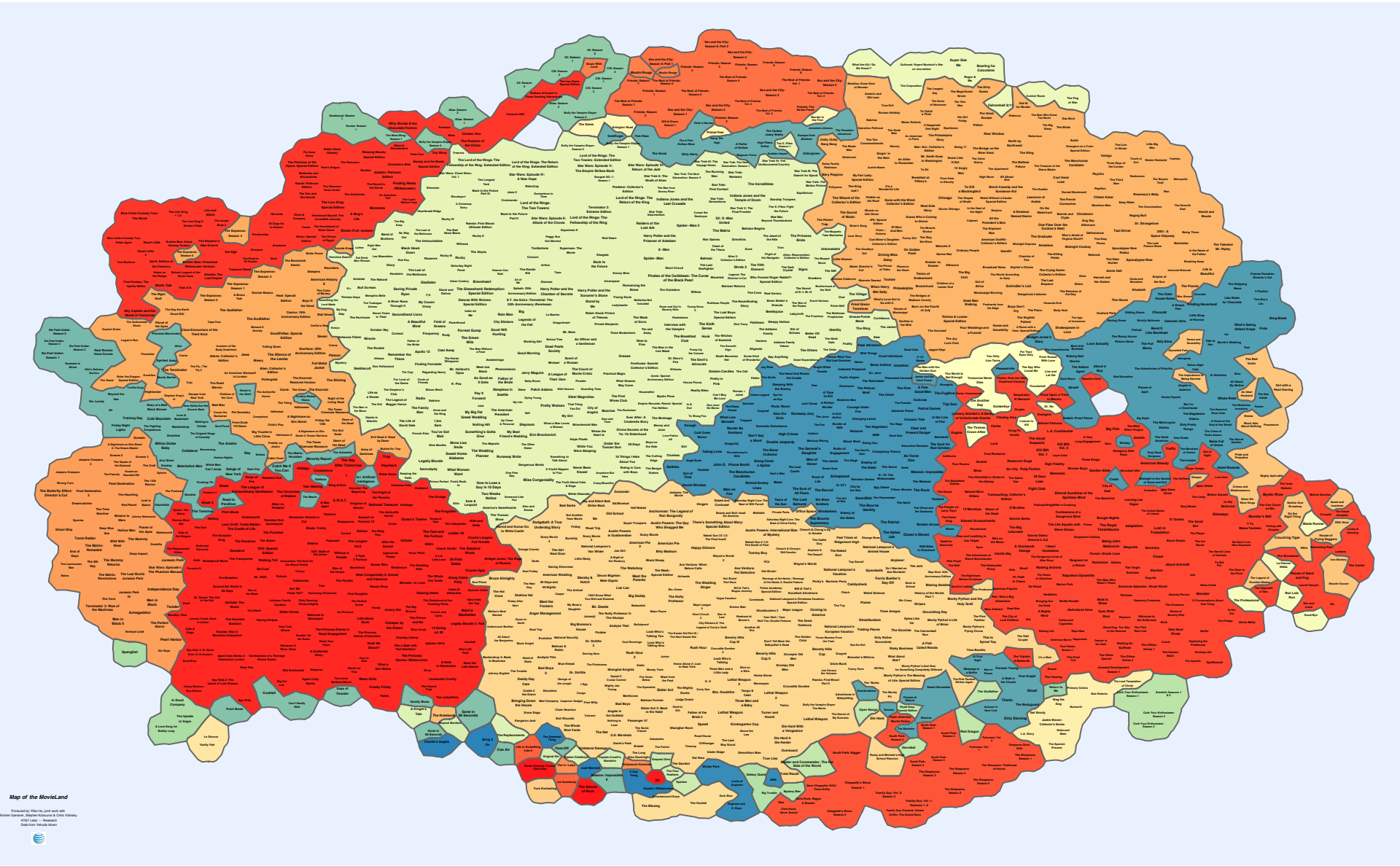

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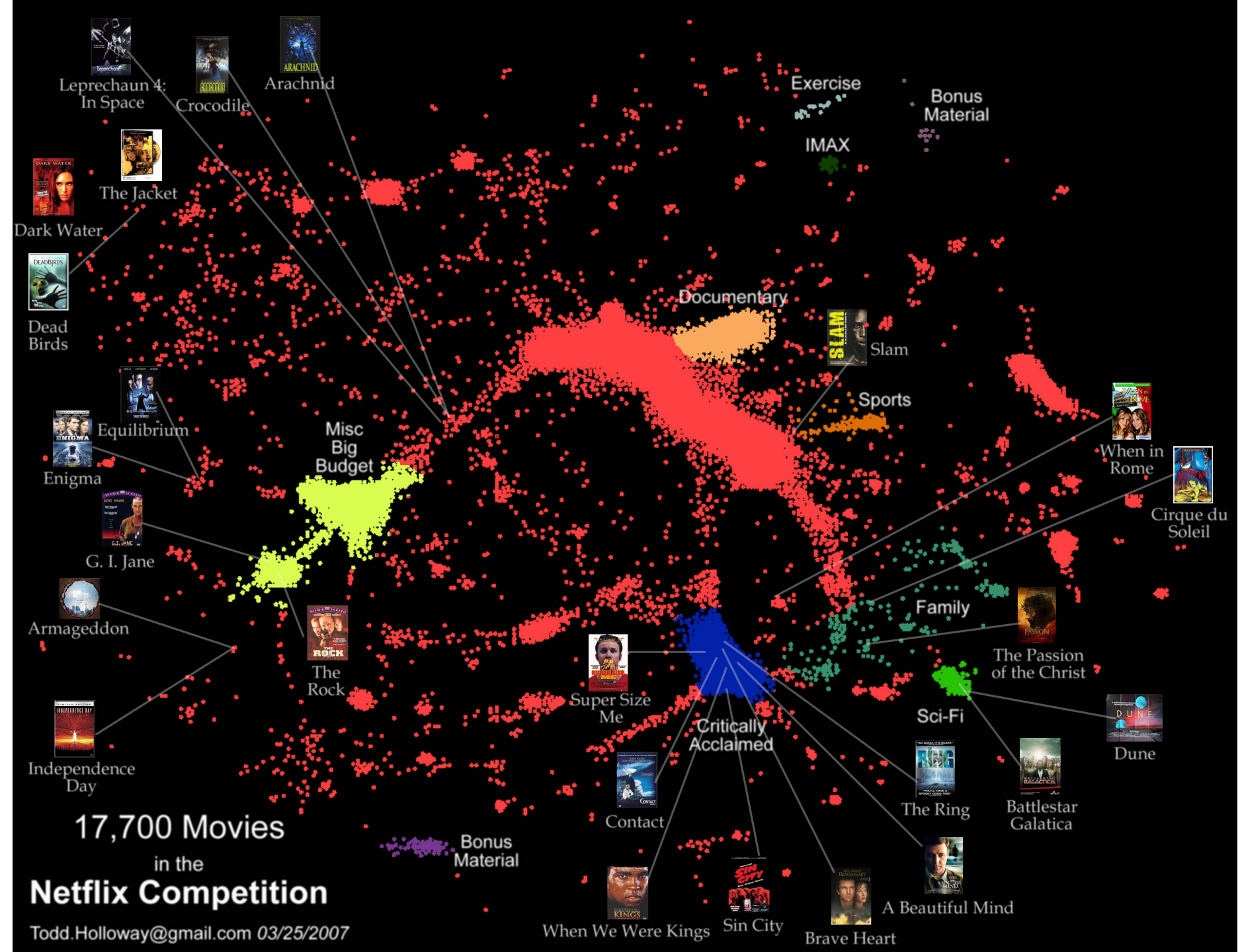

Leprechaun 4: In Space
Crocodile
Arachnid
Exercise
Bonus Material
IMAX
The Jacket
Dark Water
Dead Birds
Documentary
Slam
Sports
Equilibrium
Misc Big Budget
Enigma
When in Rome
Cirque du Soleil
G. I. Jane
Armageddon
Family
The Rock
The Passion of the Christ
Super Size Me
Critically Acclaimed
Sci-Fi
Dune
Independence Day
The Ring
Battlestar Galatica
Contact
17,700 Movies
in the
Netflix Competition
Bonus Material
When We Were Kings
Sin City
Brave Heart
A Beautiful Mind
Todd.Holloway@gmail.com 03/25/2007

The First Progress Prize

One day before the deadline…

Rank	Team Name	Best Score	% Improvement
--	No Grand Prize candidates yet	--	--
Grand Prize - RMSE <= 0.8563			
1	BellKor	0.8728	8.26
2	Gravity	0.8750	8.03
3	Dinosaur Planet	0.8753	8.00
4	ML@UToronto A	0.8787	7.64
5	Arek Paterek	0.8789	7.62
6	basho	0.8805	7.45
7	NIPS Reject	0.8808	7.42
8	Ensemble Experts	0.8841	7.07
Progress Prize 2007 - RMSE: 0.9419			

The Power of Teamwork

- First Progress Prize
  - joins forces with

 for 8.38% improvement
  - BellKor improves to 8.43%, wins $50,000
- Second Progress Prize
  - BigChaos joins BellKor for 9.44% and $50,000
- Grand Prize Team (GPT) founded by +

  - Anyone could join
  - The more you improve the GPT score, the bigger your share of the $1 million Grand Prize

The Last Call

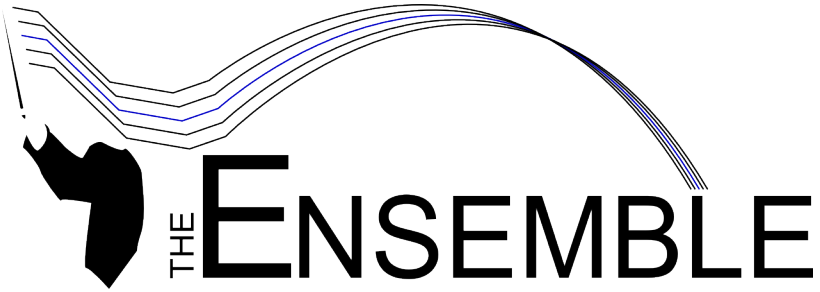
Leaderboard **10.05%** Display top 20 leaders.

Rank	Team Name	Best Score	% Improvement	Last Submit Time
1	BellKor's Pragmatic Chaos	0.8558	10.05	2009-06-26 18:42:37
Grand Prize - RMSE <= 0.8563				
2	PragmaticTheory	0.8582	9.80	2009-06-25 22:15:51
3	BellKor in BigChaos	0.8590	9.71	2009-05-13 08:14:09
4	Grand Prize Team	0.8593	9.68	2009-06-12 08:20:24

- Remaining teams had 30 days to respond
- Over the next 24 days, **30 individuals** from **11 countries** combined forces to challenge BPC

The Ensemble

- Grand Prize Team
  - Gravity
    - Gabor Takacs, Istvan Pilaszy, Bottyan Nemeth, Domonkos Tikk
  - Dinosaur Planet
    - David Lin, Lester Mackey, David Weiss
  - Joe Sill
  - Ces Bertino
  - Dan Nabutovsky
  - William Roberts
  - Wojtek Kulik
  - Willem Mestrom
  - David Purdy



- Vandelay Industries!
  - Greg McAlpin
  - Bill Bame
  - Bo Yang
  - Chris Hefele
  - Jeff Howbert
  - Xiang Liang
  - Larry Ya Luo
  - Aron Miller
  - Steve Pagliarulo
  - Opera Solutions
    - Bruce Deng, Peng Zhou, Priyanka Rastog, Arvind Gangadha, Jacob Spoelstra
  - Craig Carmichael
  - Mike Linacre
  - Edward de Grijs
  - Clive Gifford
  - Feeds2
    - Nicholas Ampazis, George Tsagas

Learn more at http://the-ensemble.com/

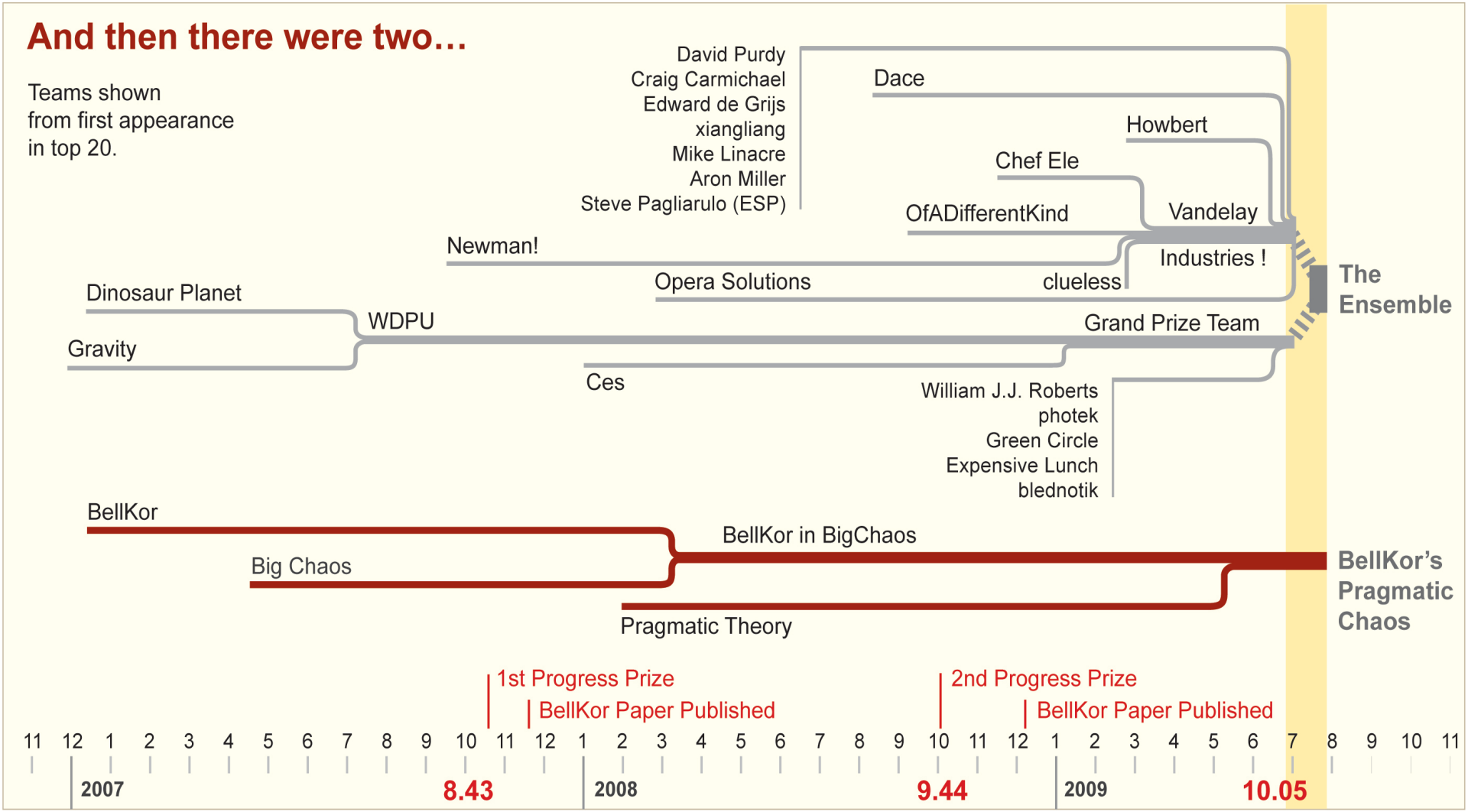
The Road to the Grand Prize

- Next to Last Day
  - The Ensemble submits
  - 10.09% improvement on Quiz Set
- Final Day, 6:18pm
  - BellKor's Pragmatic Chaos responds
  - 10.09% improvement on Quiz Set
- Final Day, 6:38pm
  - The Ensemble makes its final submission
  - 10.10% improvement on Quiz Set
- Final Day, 6:42pm: Contest closes

The Other Road to the Grand Prize

- Next to Last Day
  - The Ensemble submits
  - 10.05% improvement on Test Set
- Final Day, 6:18pm
  - BellKor's Pragmatic Chaos responds
  - 10.06% improvement on Test Set
- Final Day, 6:38pm
  - The Ensemble makes its final submission
  - 10.06% improvement on Test Set
- Tie breaker: Time of submission

The End



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