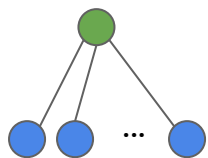


YouTube Discovery Evolution

Lukasz Heldt - heldt@google.com

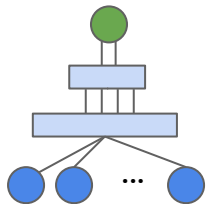
Scale

Evolution of the ML



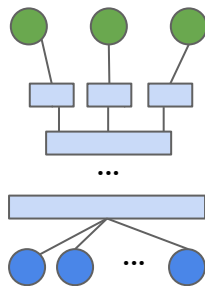
Linear Models

2015



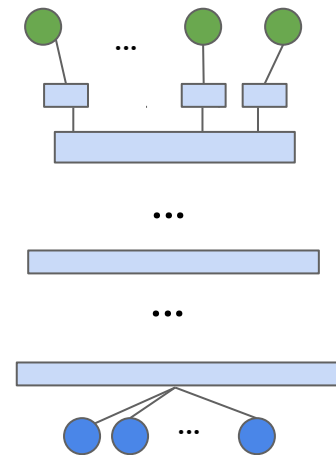
Deep Models

2016



Multitask Models

2019



Bigger Models

2023

Benefits of scaling

$O(1,000,000)$



$O(10,000,000)$



$O(100,000,000)$



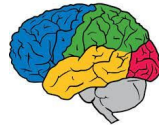
Benefits of scaling

$O(1,000,000)$



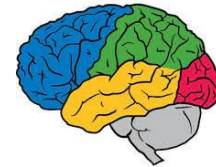
pCTR = 0.321

$O(10,000,000)$



pCTR = 0.29

$O(100,000,000)$



pCTR = 0.302

Benefits of scaling: fewer outliers








2015








2023



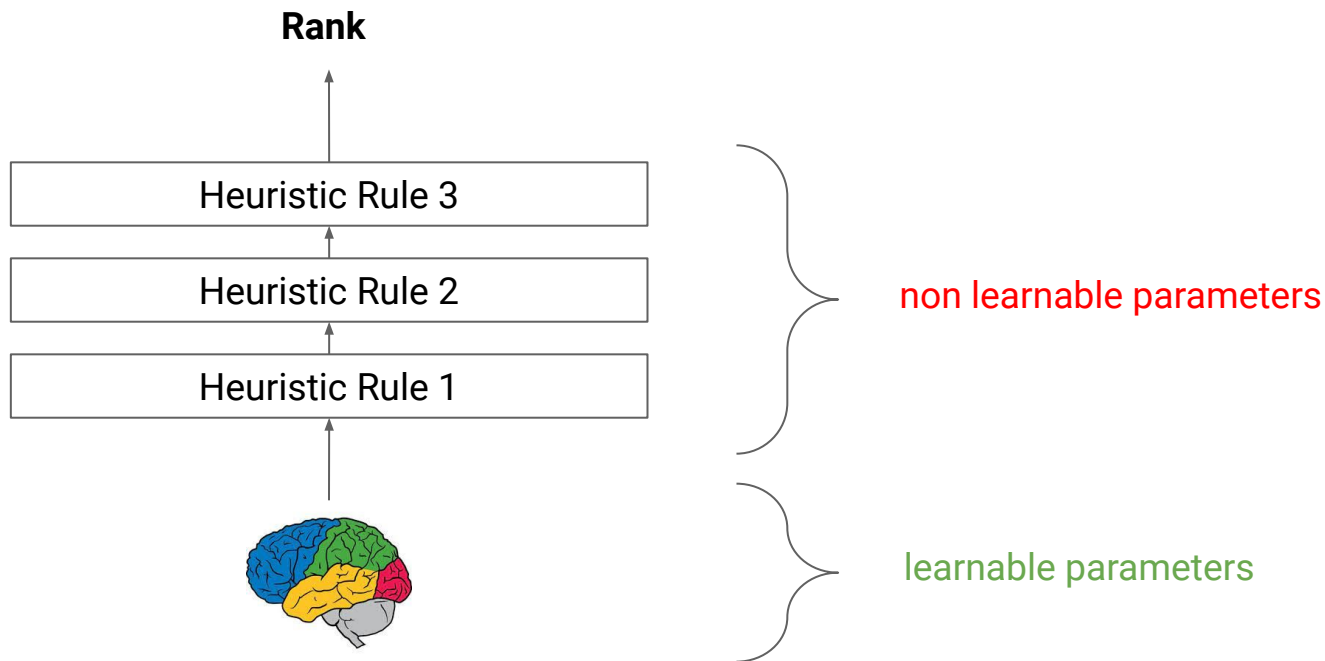
Shelby GT350: A Carroll Shelby Legacy - Pebble Beach Week

Motor Trend Channel 1.7K

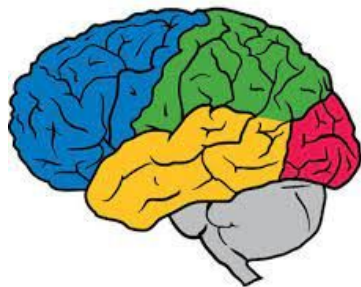
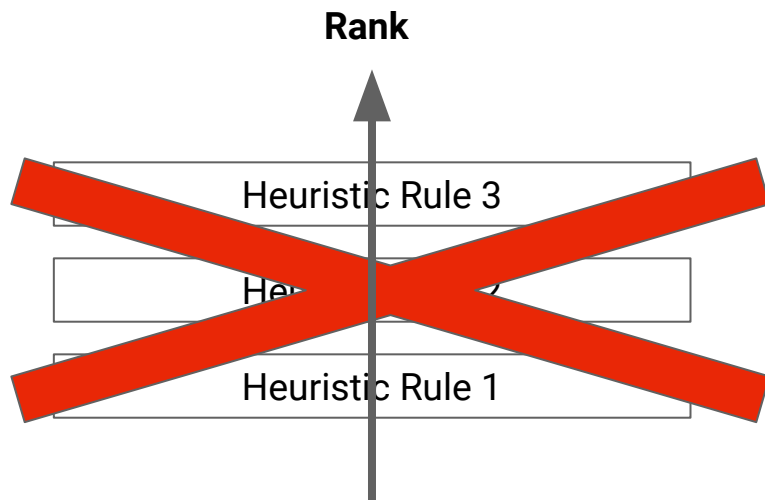
-  **Border 2 Border! Epic American Road Trip in a Toyota Tundra TRD Pro - Dirt Every Day**
by Motor Trend Channel
537,965 views
-  **Stirling Moss: Racing Legend and Mille Miglia Champion - Pebble Beach Week**
by Motor Trend Channel
29,984 views
-  **Atomic LS7 Van Rear-Axle How-To and Drag Test! - Hot Rod Garage Ep. 22**
by Motor Trend Channel
425,469 views
-  **2016 Mazda MX-5 Miata: Does it Actually Get Any Better Than This? - Ignition Ep. 137**
by Motor Trend Channel
370,397 views
-  **Oops Right Moment Pics / Oops / Huge Funny Fail Compilation**
by Yes-FunnyMedia
1,078,425 views
-  **Try Not To Laugh Best Vines Pranks Fails and Funny Videos THE FINAL**
by Prank Army
3,429,630 views
-  **10 Most Ridiculous Things Bought By Billionaires**
by Top Trending

-  **How Carroll Shelby made the 1965 Mustang GT350. What...**
Legendary Motorcar
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-  **Shelby GT350 DRIFT | PURE SOUND | FPV DRONE**
Michael Kmoch
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-  **1968 Ford Mustang / Shelby Cobra Commercial featuring...**
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CNN
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-  **Stirling Moss: Racing Legend and Mille Miglia Champion ...**
MotorTrend Channel
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x924t
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Benefits of scaling: simplicity

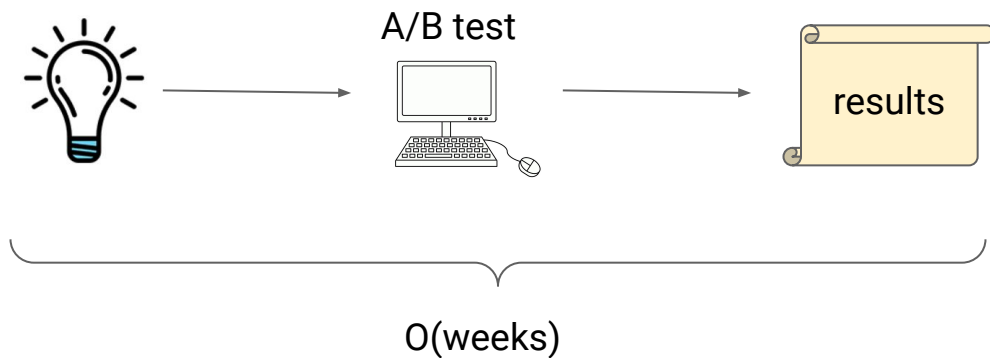


Benefits of scaling: simplicity

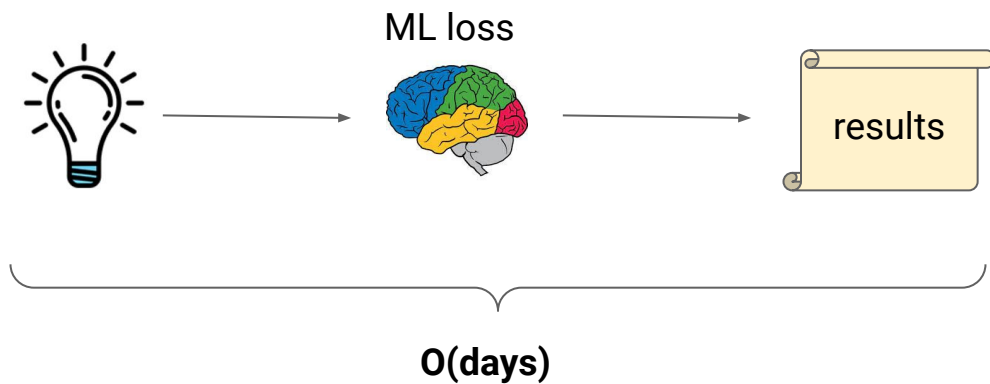


learnable parameters

Benefits of scaling: reliable offline evals



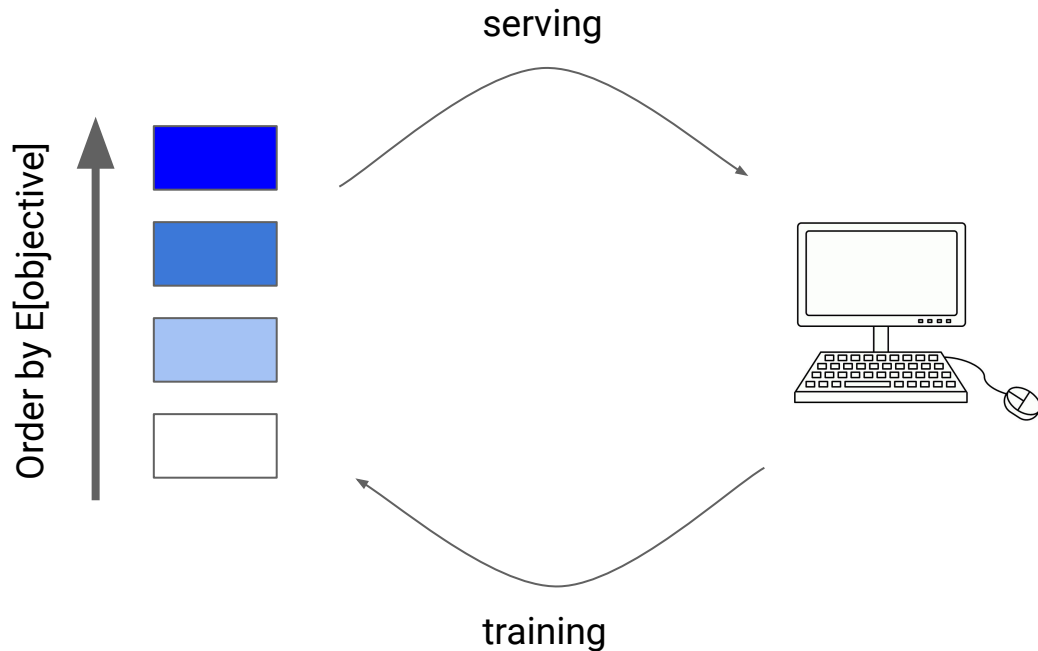
Benefits of scaling: reliable offline evals



Objective Maximization

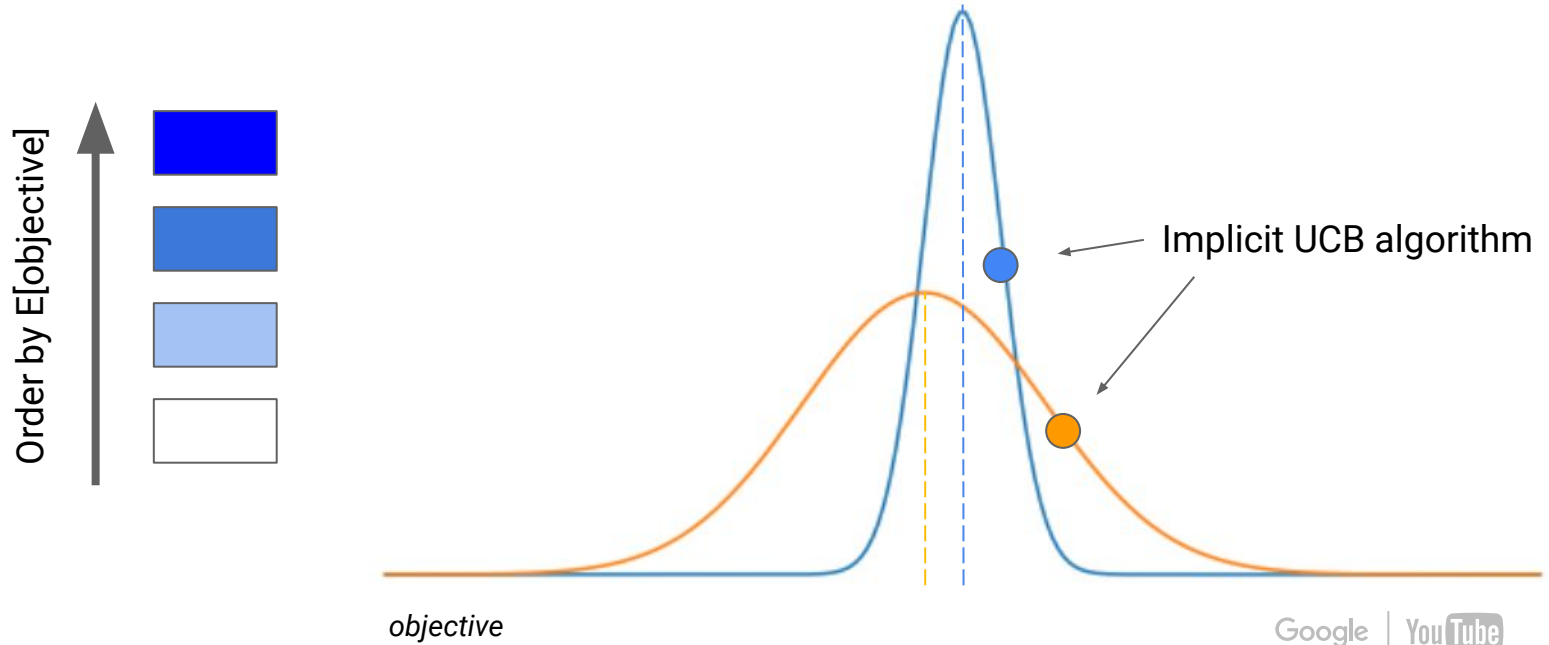
Observation

Every ranked system with a feedback loop is an **RL** system.



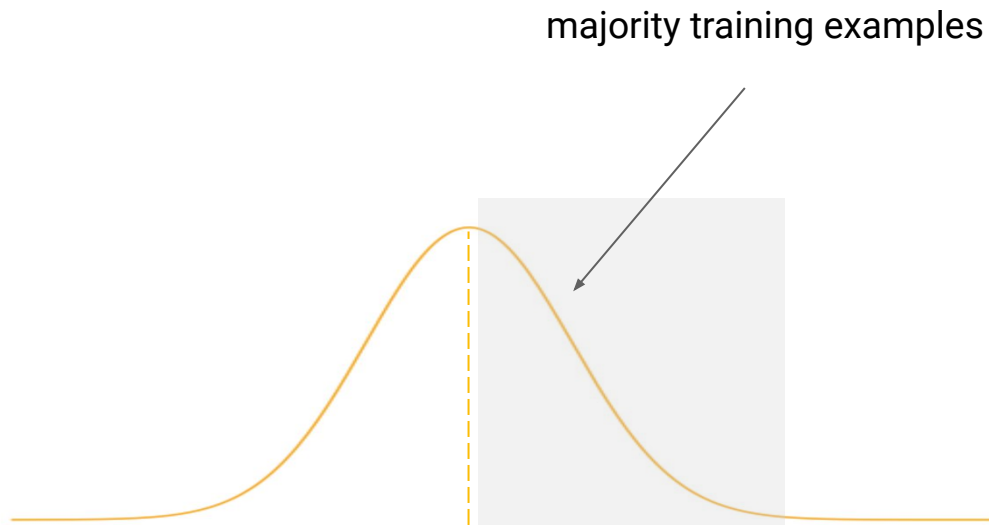
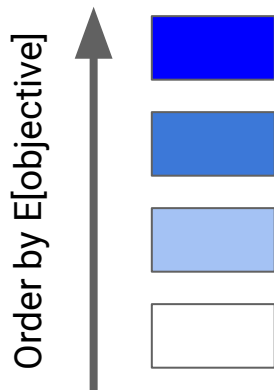
Observation

Every ranked system with a feedback loop is an **RL** system.



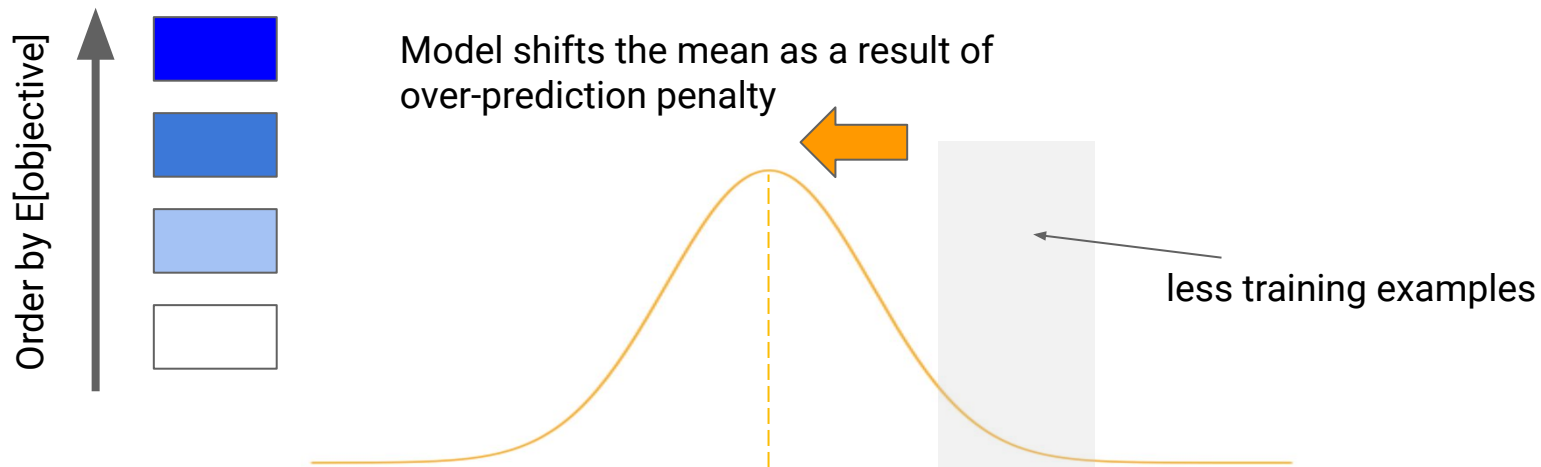
Observation

Every ranked system with a feedback loop is an **RL** system.



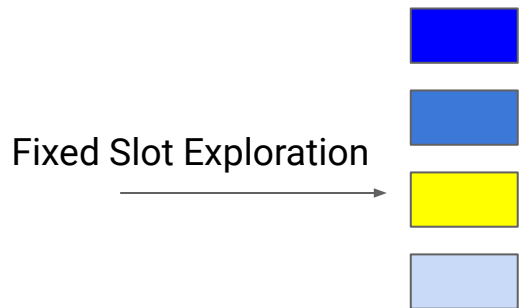
Observation

Every ranked system with a feedback loop is an **RL** system.



Consequences

1. the system continuously moves towards its objective
→ the choice of objective is critical
2. higher variance leads to higher penalty
→ reducing variance is very important (e.g. through scale)
3. spontaneous exploration is not sufficient
→ invest in intentful data acquisition



Modeling Product Behavior

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who let me do this lol

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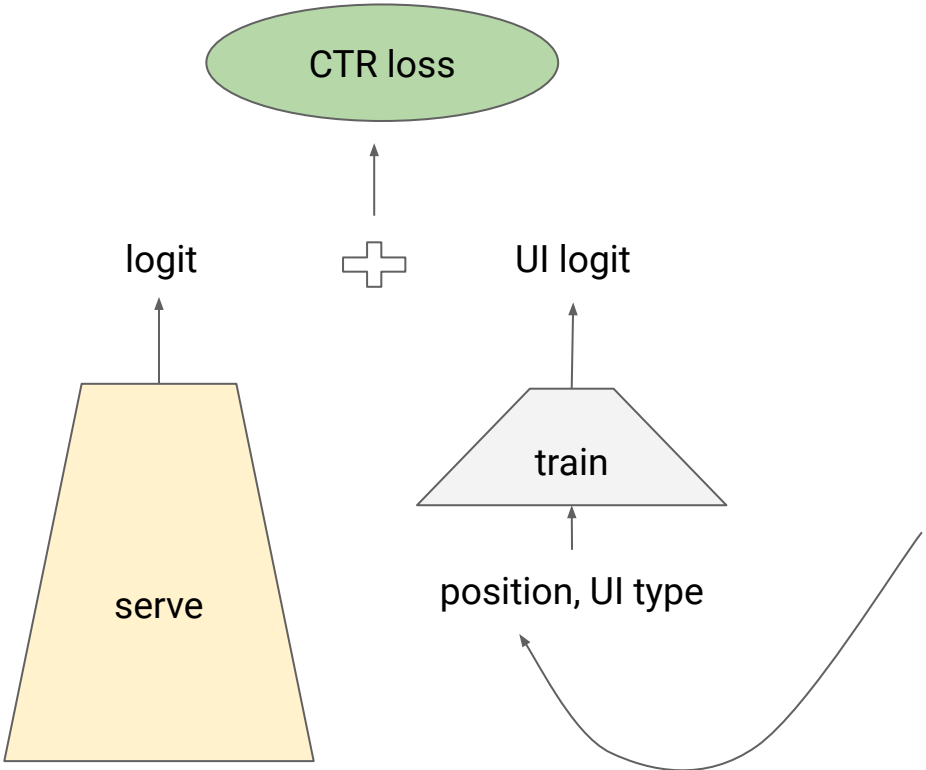
Homeless Man Buys A Lamborghini
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7 Days Stranded At Sea


Many competing recs


Appealing recs affect watching behavior


Positional Bias





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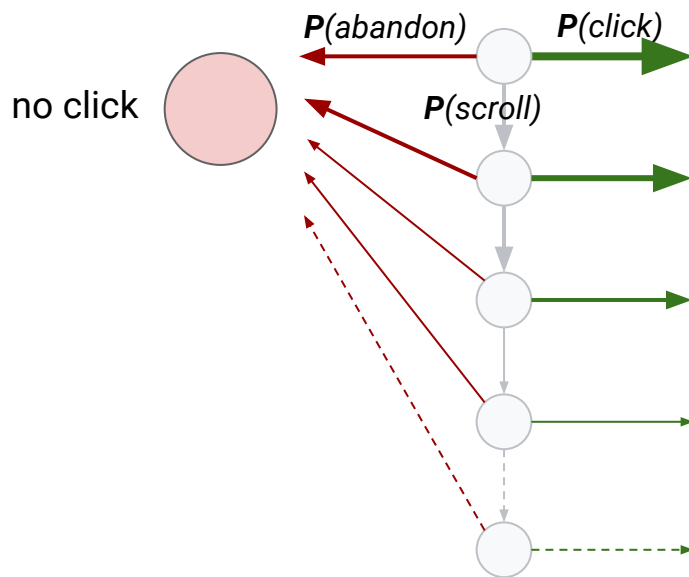
2  **Most Expensive Airplane Ticket!** ⋮
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DAY #7


User Browsing Model





- 

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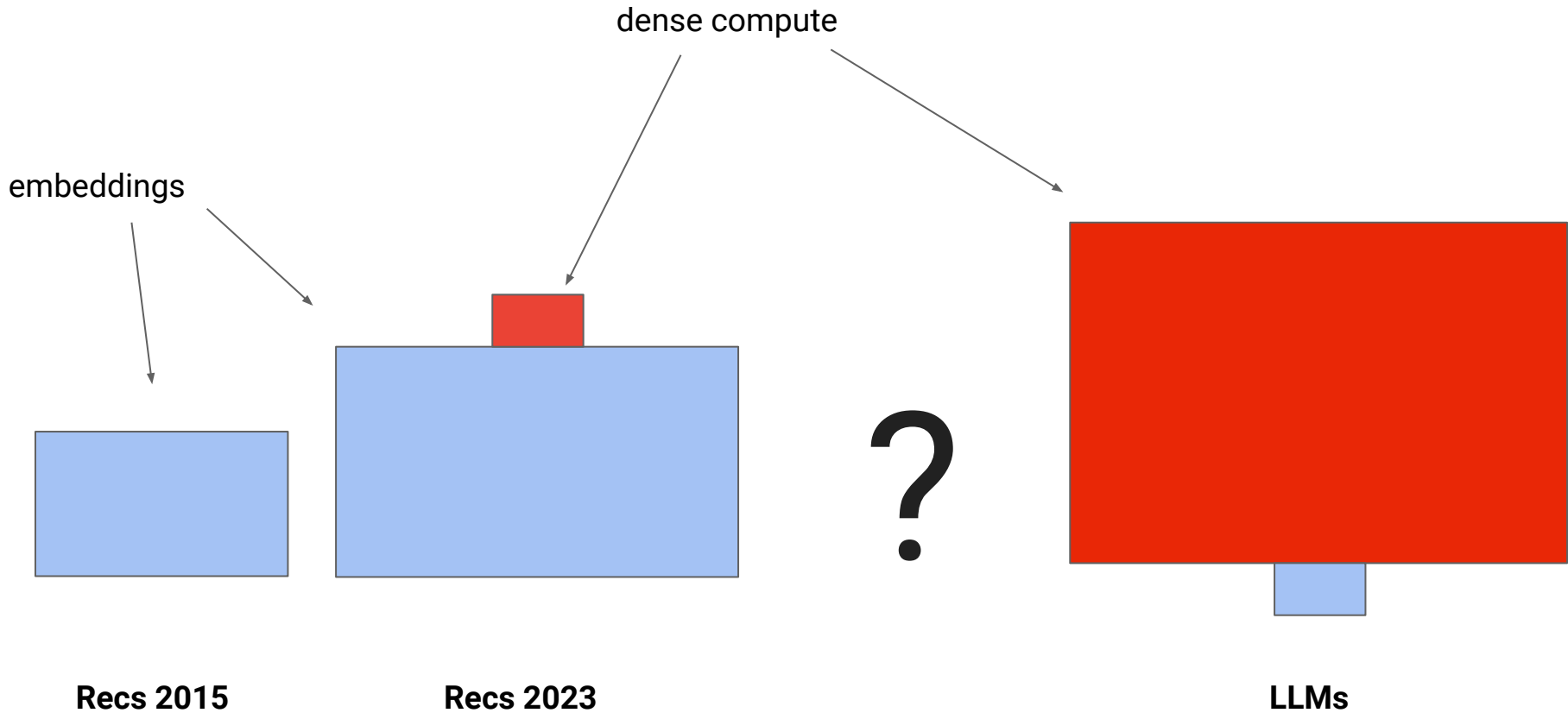
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7 Days Stranded At Sea ⋮
DAY #7

Future



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