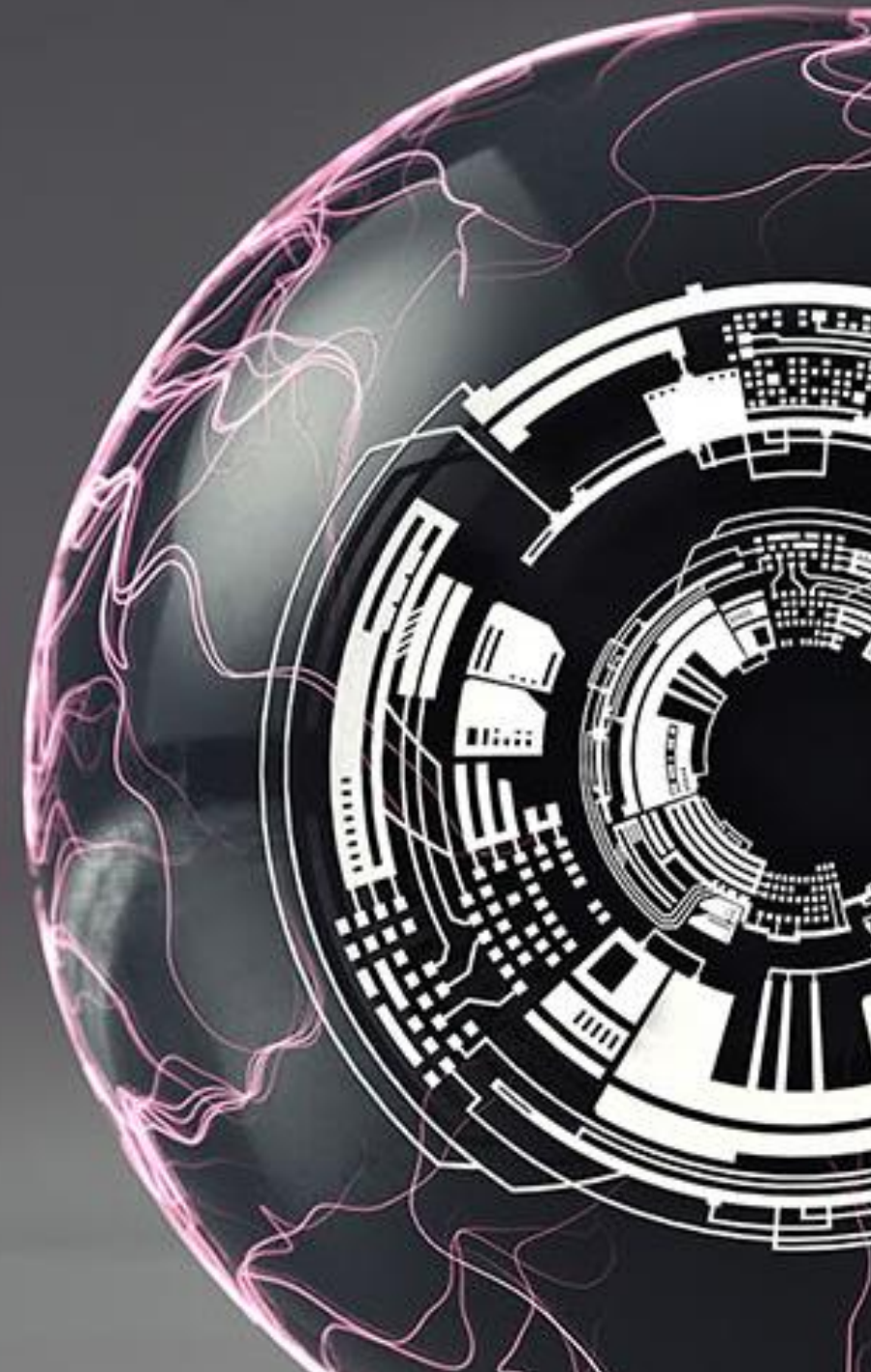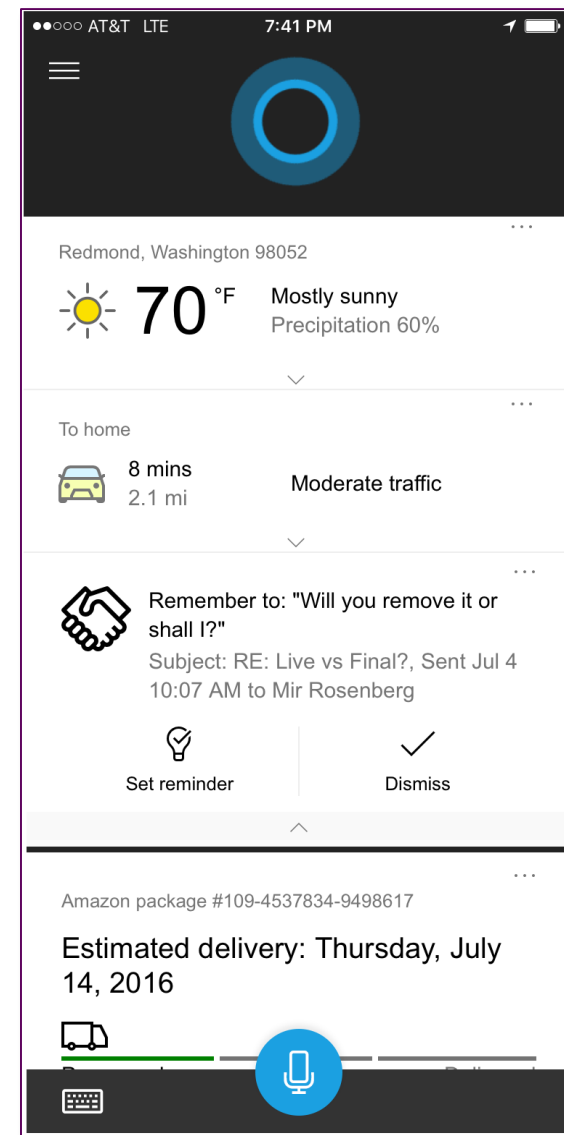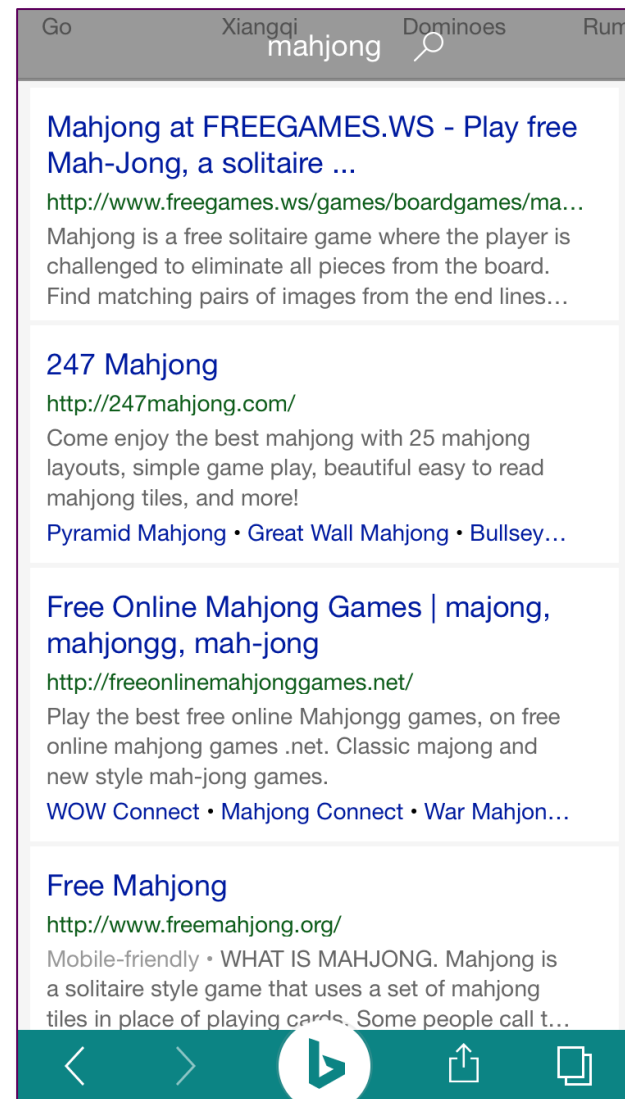# Lessons from Building Large Scale AI Systems

Rangan Majumder
Group Program Manager of
Relevance and AI

What is a large scale?

- Hundreds of **billions** of documents
- **Billions** of entities
- **Trillions** of entity relationships
- **Hundreds of billions** of interactions
- **Hundreds of millions** of users
- **Thousands** of engineers

Lesson #1: You get what you measure

You get what you measure

- If you really want to improve something, start by measuring it. If you aren't measuring it, don't expect it to improve

- Measurement Framework:
  - What are your product goals? What are the key tasks and scenarios?
  - What signals are correlated to those goals?
  - Leverage those signals to build metrics that measure whether you are successfully moving towards your goals
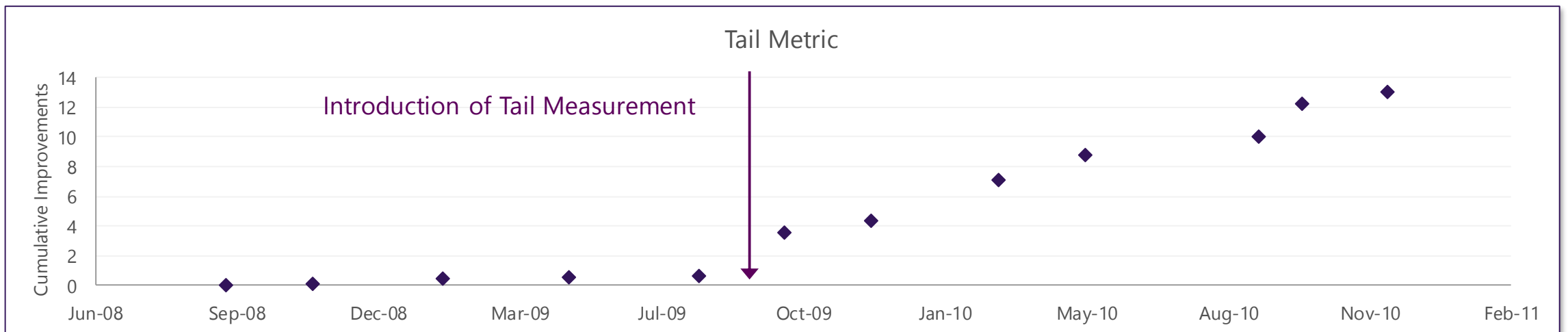
Lesson #2: Data is powerful, Instrument Everything

Data is Powerful, Instrument Everything

- ## Can you build a chart of what is happening in your system?
  - If you can't, then don't even try machine learning
  - First build a great instrumentation pipeline and platform
- ## Data is powerful
  - Its unreasonably effective: more data > smarter algorithms
  - Its great to analyze and understand and get ideas for future improvements
  - Data helps you validate if your ideas are good (AB Testing)

Lesson #3: Experiment a lot

Interactive Portion...

Which has more revenue/pixel?

Esurance® Auto **Insurance** - You Could Save 28% with Esurance.   Ads
www.esurance.com/California
Get Your Free Online Quote Today!

Esurance® Auto **Insurance** - You Could Save 28% with Esurance.   Ads
www.esurance.com/California
Get Your Free Online Quote Today!
Get a Quote · Find Discounts · An Allstate Company · Compare Rates

A   **B**

In the same amount of space we can put either 4 As, or 3 Bs

- Raise your left hand if you think A Wins
- Raise your right hand if you think B Wins
- Don't raise your hand if they are the about the same

Experiment a lot

- No matter how smart you are, it is really hard to tell what is the ideal product from intuition alone

- Solution: Experiment a lot, try different ideas in parallel, try them fast. Build, Measure, Learn

- Optimize experimental throughput. Its never fast enough, agility is important

Bing Experimentation Growth (2008-2015)

Exponential growth until mid-2014, now flattening off Mobile (and others not shown) ramping up
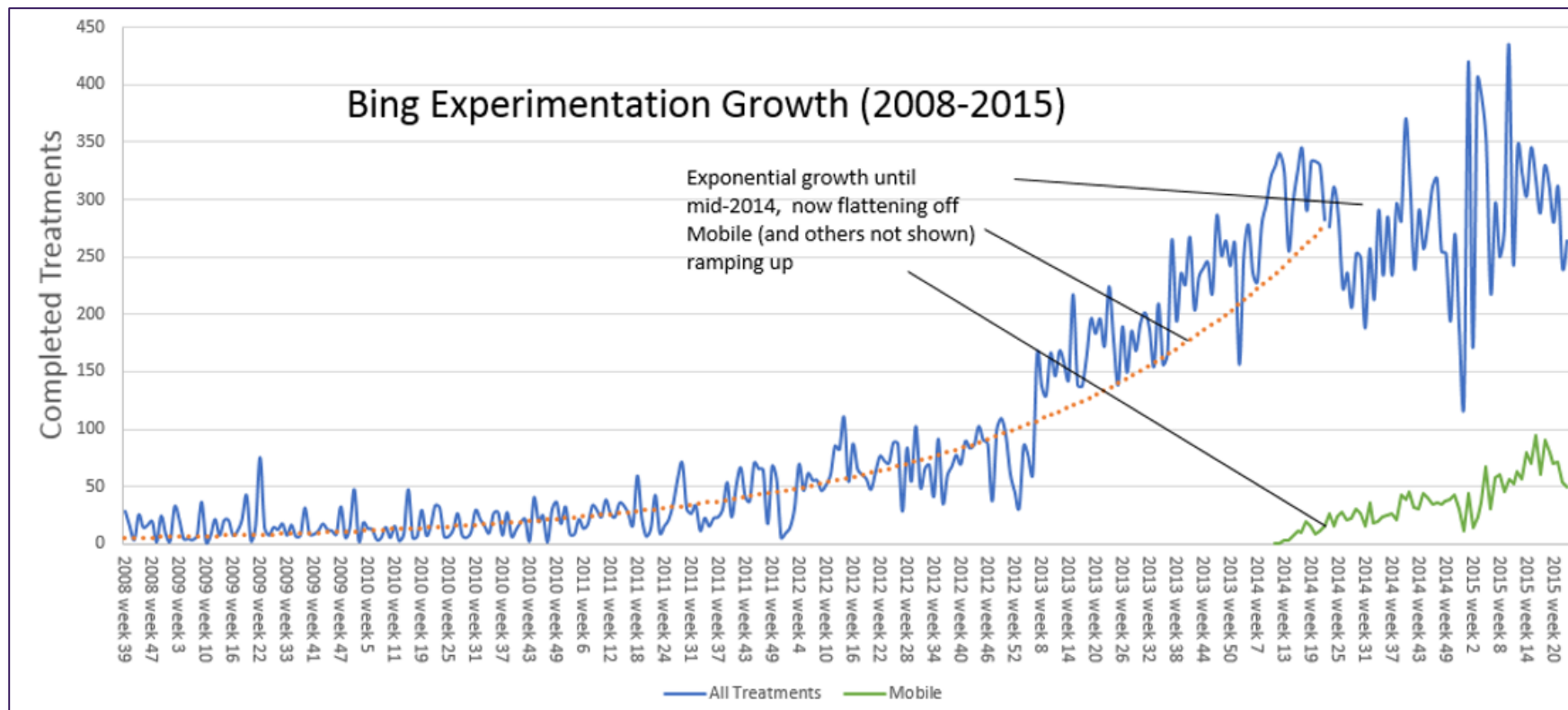
Lesson #4: Avoid P-Hacking

HEALTH ALERT

Today's NEWS

SUGAR MAY FUEL GROWTH OF CANCER
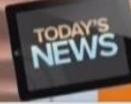STUDY SAYS WESTERN-STYLE DIET PARTLY TO BLAME

TODAY.com

FOX NEWS LIVE

RPT: GLASS OF RED WINE EQUIVALENT TO HOUR OF GYM TIME

SUNDAY Housecall

FOX NEWS channel

DEHYDRATION DANGER
RPT: DRIVING DEHYDRATED SAME AS DRIVING DRUNK

MEDICAL A TEAM

JULY 11, 2014

TIME

## Scientists Say Smelling Farts Might Prevent Cancer

It has been a weird week in health news. First doctors said that Justin Bieber might save young boys' lives (the "hip" bowl cut is actually a form of sun protection — skin cancer be gone!), and now scientists out of the University of Exeter are implying that smelling farts could actually prevent cancer, among other diseases.

These are real studies with SS results! What's going on?

Everything we eat both causes and prevents cancer

● = One medical study

Relative risk of cancer

Protects against cancer ← → Causes cancer
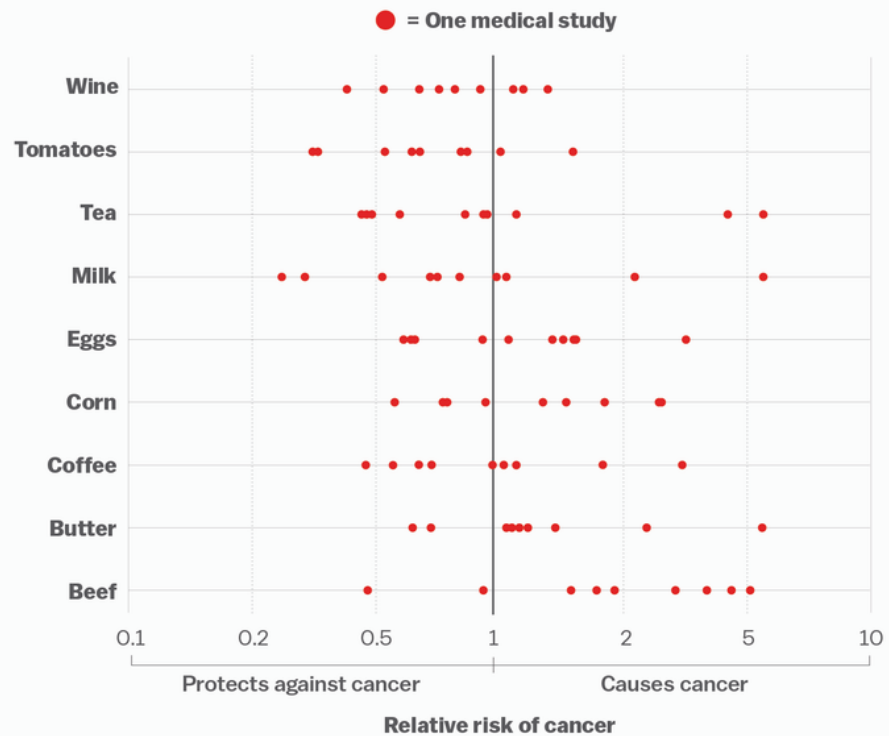
SOURCE: Schoenfeld and Ioannidis, *American Journal of Clinical Nutrition*
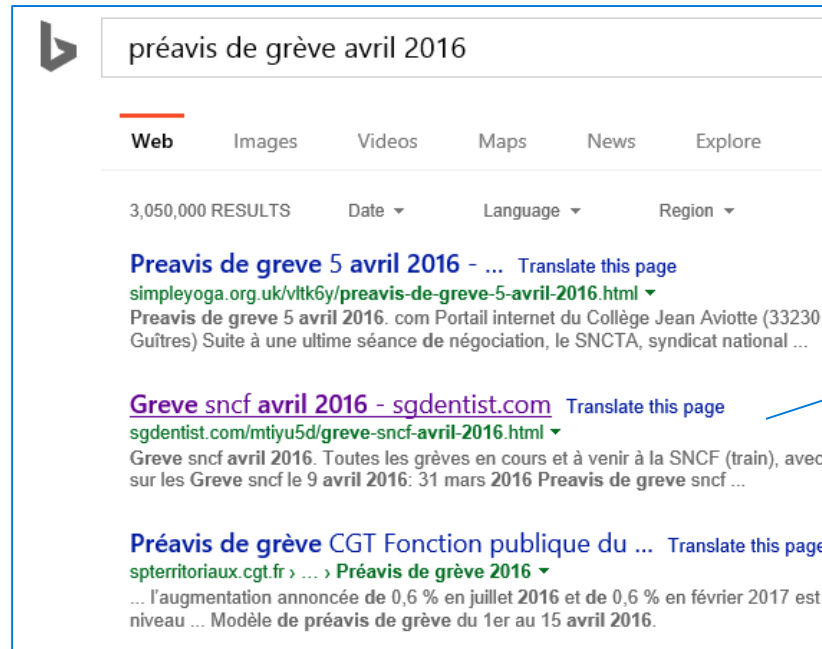
Vox

P-HACKING

P-Hacking

- Why does this happen?
  - Your team is under pressure to get results
  - You've empowered them with a large scale ML system
- Causes for accidental p-Hacking
  - Too many attempts
  - Experiments are underpowered / sample size too small
  - Accidental bias in control and treatment group
- Solution
  - Replication: You real impact is measured on a final experiment on a completely new sample

Microsoft

Lesson #5: Prepare for Adversarial Conditions

Adversarial Conditions

- If you are making money, someone will want a piece of your business
  - Many bad guys out there
  - Others are good intentions but strayed to far

- Don't underestimate your adversaries
  - They are very clever, creative, and relentless

The End