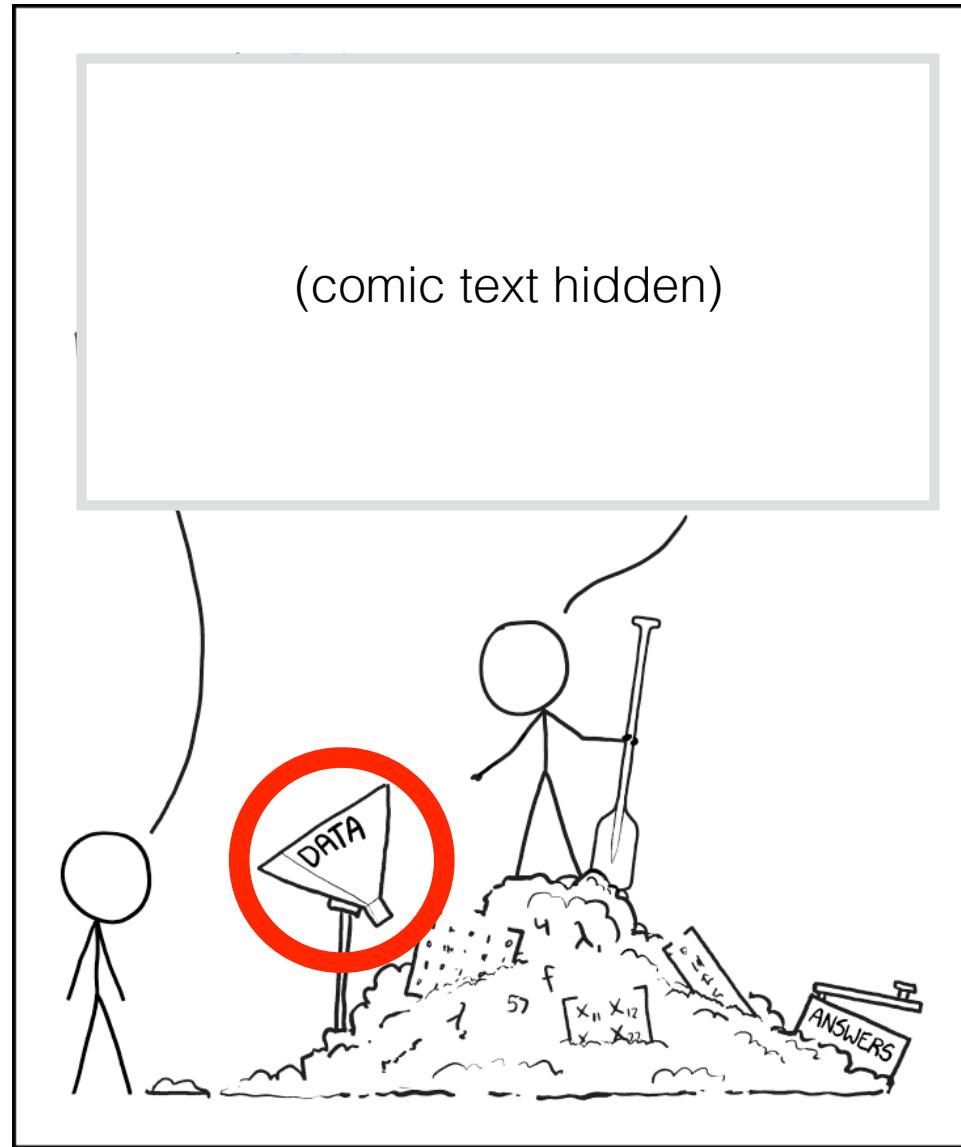


NEXT: Crowdsourcing, machine learning and cartoons

Scott Sievert
@stsievert  

Link to slides and proceedings:
tinyurl.com/scipy-next

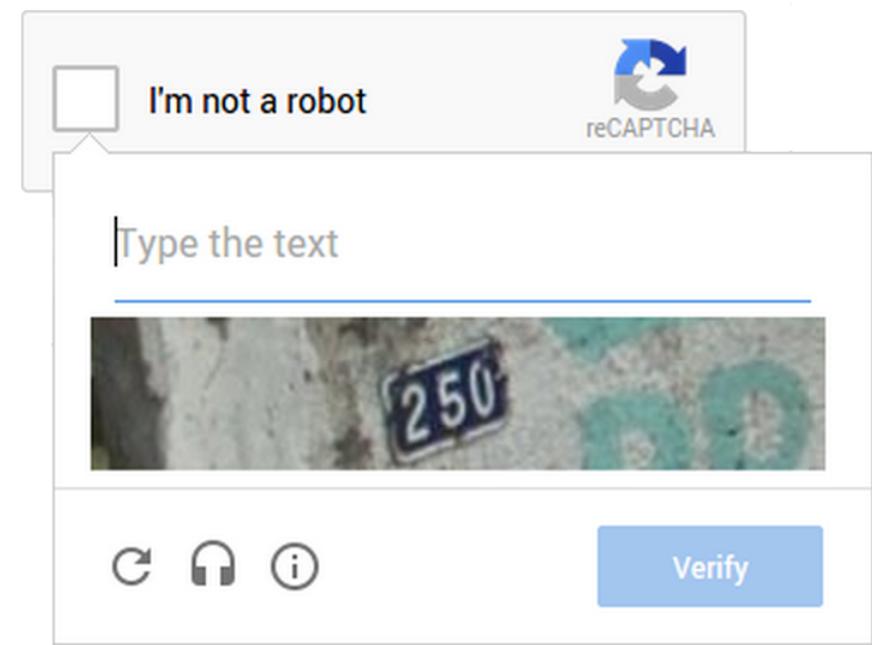
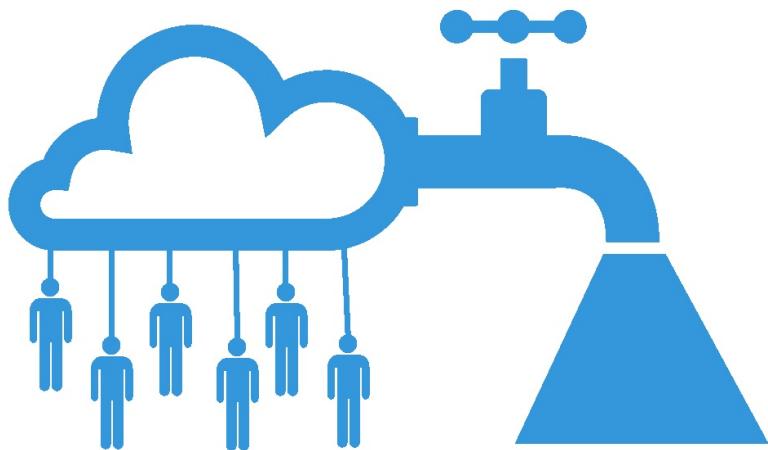
Problem



Data collection can be costly

Example

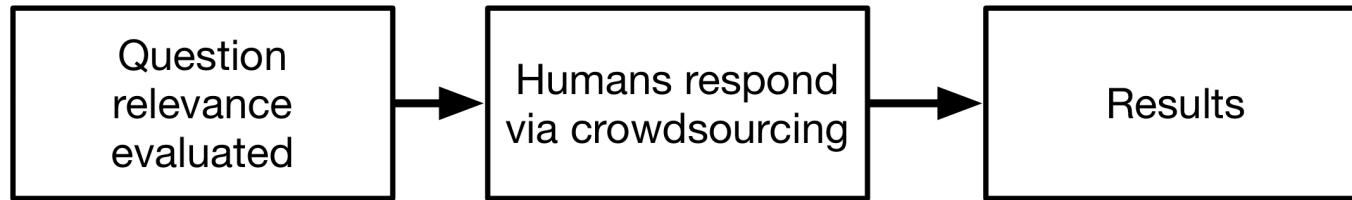
Data collection done with crowdsourcing can be expensive



Goal: achieve goal with minimal responses

One solution

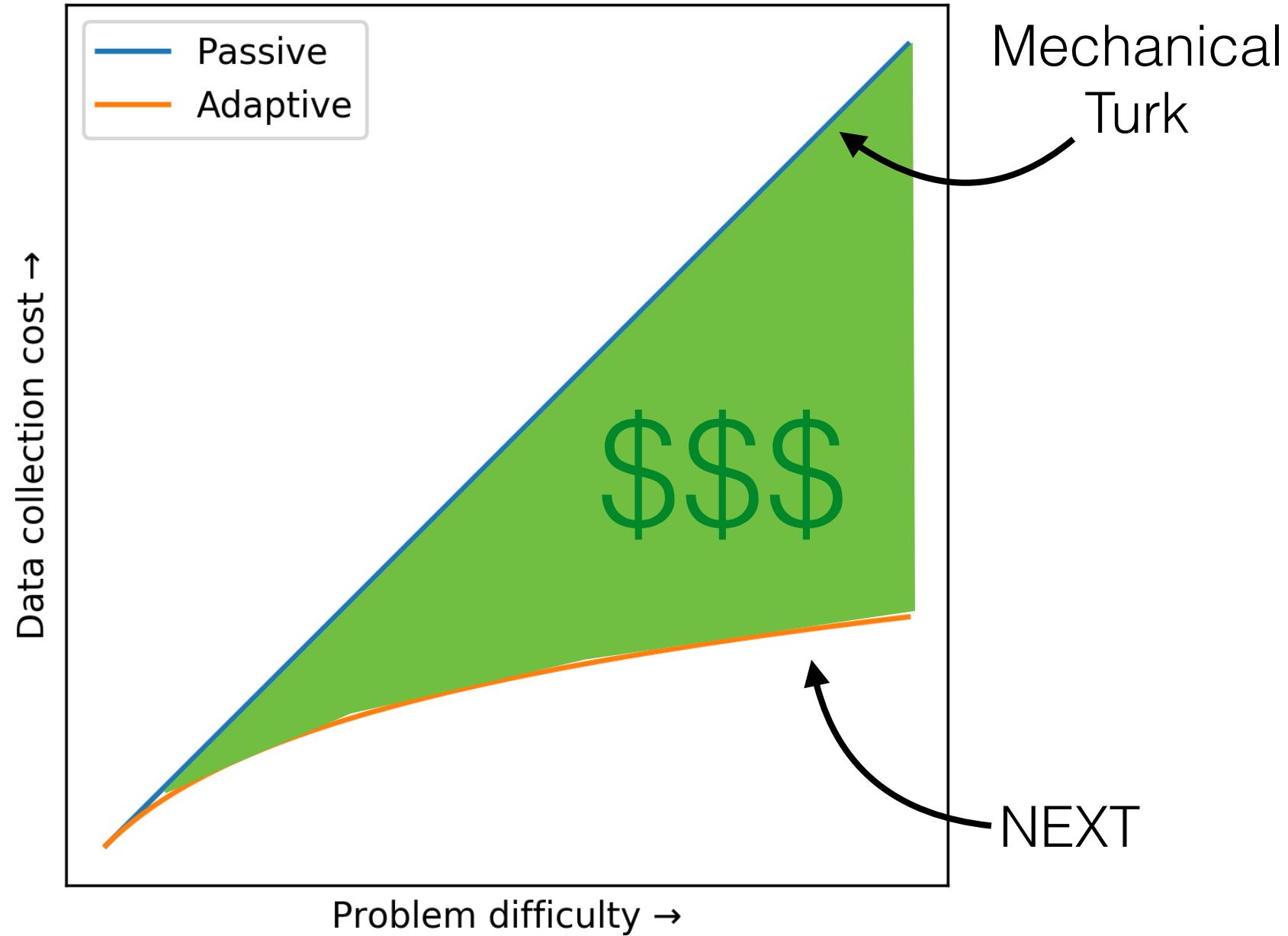
Existing crowdsourcing systems are *passive*



Adapting to previous responses requires fewer data

Goal: adapt to previously collected responses

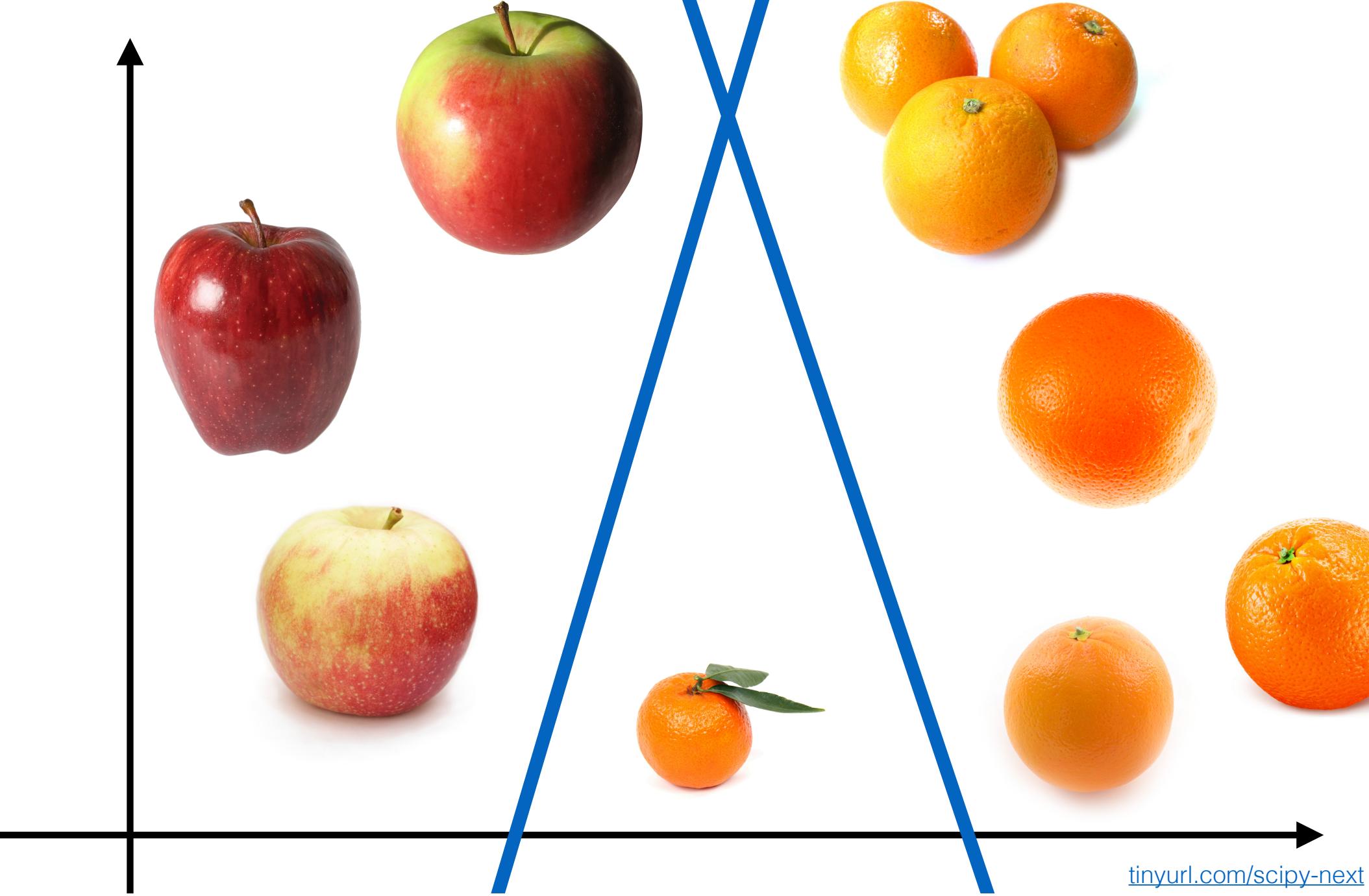
Benefits



Adaptive sampling can have large benefits

Example solution

*Adapting to previous responses
yields better results*



nextml.org

NEXT

ASK BETTER QUESTIONS.

GET BETTER RESULTS.

FASTER. AUTOMATED.

[GitHub](#) [Paper](#) [Docs](#)

[Blog](#) [Team](#) [Data](#)

Fork me on GitHub



[Lalit Jain](#)



Daniel Ross



[Rob Nowak](#)



[Kevin Jamieson](#)

Homepage: <http://nextml.org>

Source: <https://github.com/nextml/NEXT>

Documentation: <https://github.com/nextml/NEXT/wiki>



-amplab



Sandia
National
Laboratories

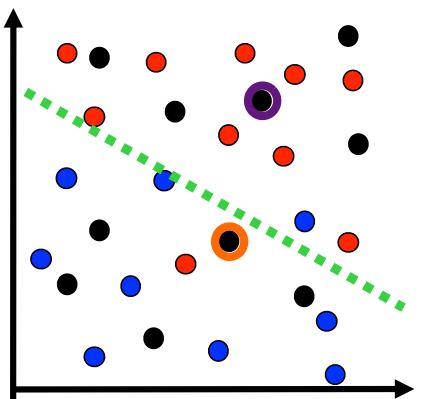
tinyurl.com/scipy-next

NEXT users

Theory

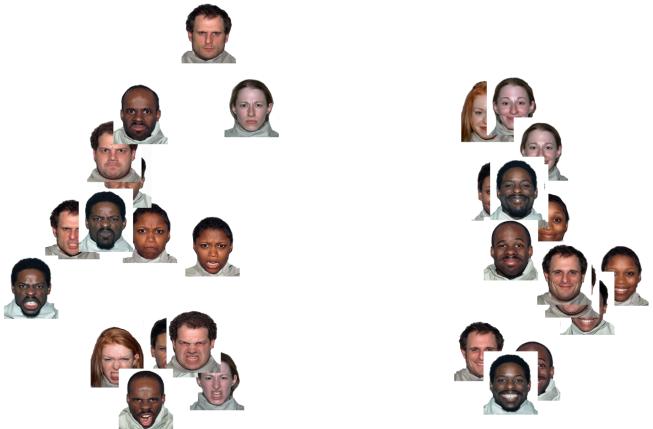
ML Researchers

Air Force Research Lab
uses NEXT for active
image classification.



Experimentalists

UW Psychology uses
NEXT to find the best
algorithms for adaptive
data collection in cognitive
science.



Practice

Practitioners

The New Yorker uses
NEXT to crowd-source
the weekly cartoon
caption contest.

THE NEW YORKER CARTOON CAPTION CONTEST

A cartoon strip from The New Yorker's weekly cartoon caption contest. It shows a man in a suit standing at a podium, speaking into a microphone. In the background, there are other people and a window. The cartoon is framed by a white border.

And may I introduce my wife,
Janet, joining us from
Minneapolis.

Of course you can speak off the
record.

	nextml / NEXT
	aashish24 / NEXT
	abiswas3 / NEXT
	alphaprime / NEXT
	aniruddhajb / NEXT
	AvinWangZH / NEXT
	ayonsn017 / NEXT
	caomw / NEXT
	connectthefuture / NEXT
	crcox / NEXT
	dconathan / NEXT
	robinsonkwa / NEXT
	jattenberg / NEXT
	jimwmg / NEXT
	justicelee / NEXT
	juthawong / NEXT
	liamim / NEXT
	mlewis / NEXT
	NandanaSengupta / NEXT
	naveendennis / NEXT
	pedmiston / NEXT
	samim23 / NEXT
	stsievert / NEXT
	BhargavaA / NEXT
	suchow / NEXT
	sumeetsk / NEXT
	widoptimization / NEXT
	worldbank / NEXT

Example problem

THE NEW YORKER



[Bob Mankoff](#)

YOUR CAPTION

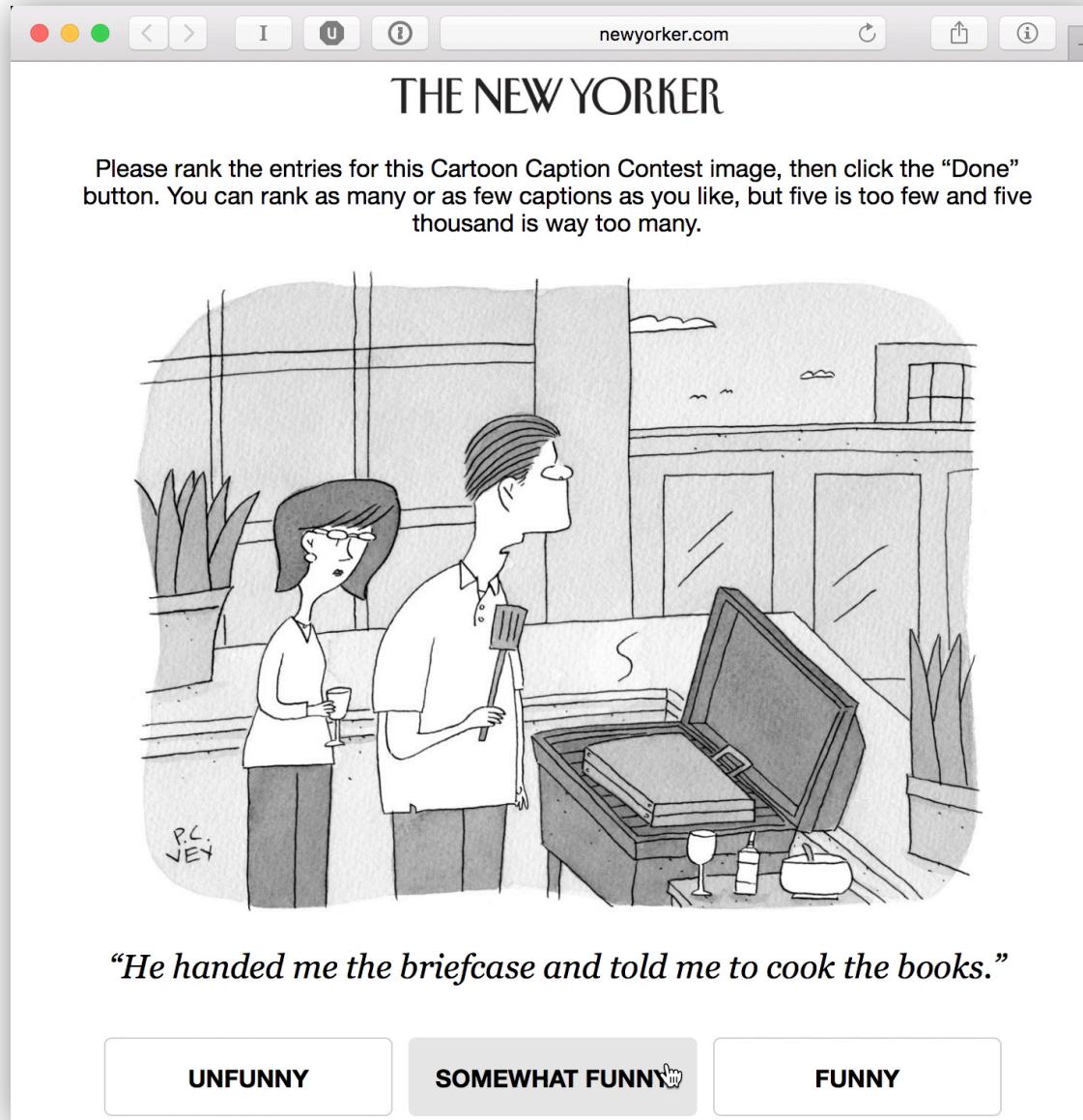
Enter your caption (250 characters or fewer):

The New Yorker has to find the funniest caption from ~5,000 captions

Interface

<http://www.newyorker.com/cartoons/vote>

<http://nextml.org/captioncontest>



Dashboard

Screenshot of the NEXT Experiment Dashboard interface.

The dashboard shows the following components:

- Header:** Browser window title bar showing "ec2-34-208-101-150.us-west-2.compute.amazonaws.com".
- Top Bar:** "NEXT Experiment Dashboard" and "NEXT - b85faed0ebbd9c6256bdcaa5f2951a" tabs.
- Navigation:** "NEXT" logo, "EXPERIMENT", and "SYSTEM" buttons.
- Visuals:** A histogram titled "Histogram of time responses received" showing a distribution of response times.
- Experiment Info:** Start date: 2017-06-26 14:39:13.745959 UTC, Dashboard data generated: <1 minute ago, Number of participants: 14111, Number of answers: 423367.
- Rankings:** A table showing the top 5 captions with their scores, precision, counts, and funny/unfunny metrics.
- Data from contests:** A callout box containing the URL <https://github.com/nextml/caption-contest-data>.

Rank	Target	Score	Precision	Count	Unfunny	Somewhat Funny	Funny
1	I'd better give it a little longer. It's a really tough case.	2.0921	0.0135	3107	751	1319	1037
2	He told me to cook the books, but didn't say for how long.	1.9946	0.0113	4458	1280	1922	1256
3	Hopefully cooking the books works better than laundering the money.	1.9777	0.0177	1880	577	768	535
4	Something t					1568	1336
5	No, I won't be going back to work on Monday. Why	1.9679	0.0123	3864	1193	1602	1069

Goal

Adaptive
sampling
algorithms

Crowdsourcing

fewer responses
more accurate models

real-world data
participant fatigue
algorithm delays
participant label quality

Goal: let both parties *easily* use NEXT

tinyurl.com/scipy-next

Software uses

By default, NEXT can be applied to 3 problems

Select face on the bottom most similar to the face on top



Pool based triplets

Cardinal Bandits



"Sorry, everything goes out one ear and out the other."

UNFUNNY

SOMEWHAT FUNNY

FUNNY

comic by [P. C. Vey](#)

Dueling Bandits

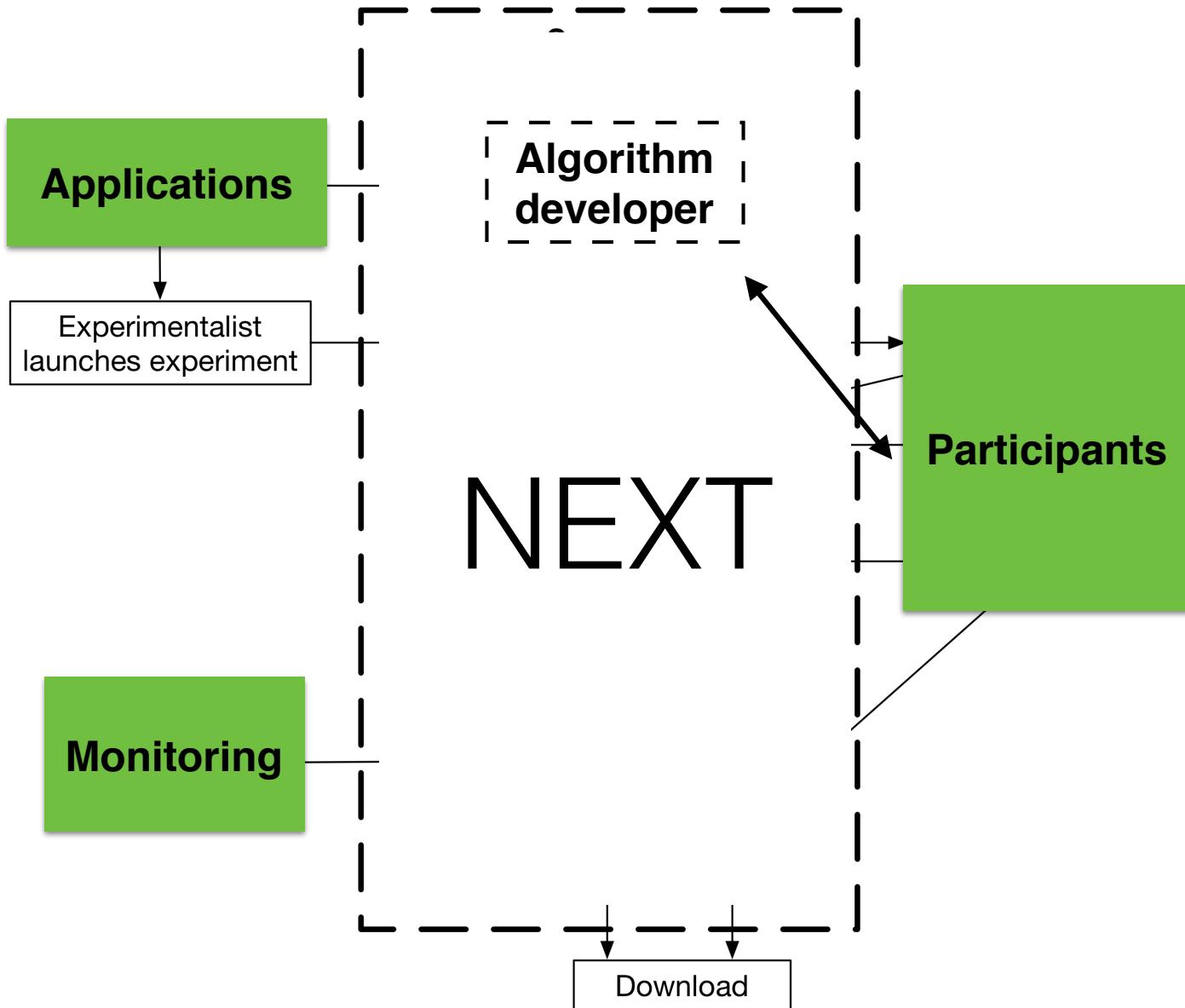
Select the street that looks safer



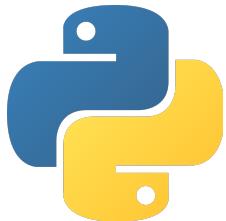
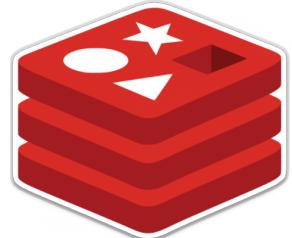
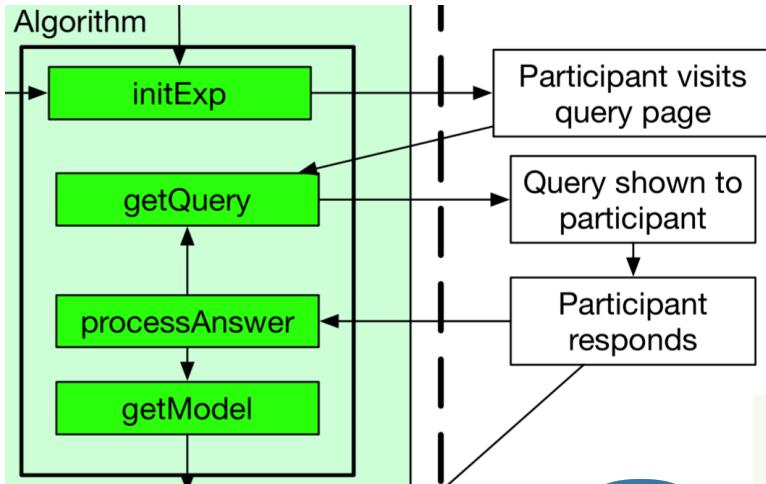
NEXT can also be used with REST API

tinyurl.com/scipy-next

NEXT use

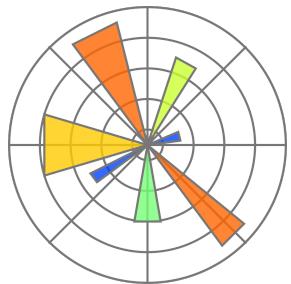
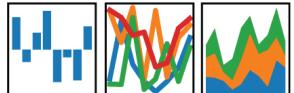


Algorithm developer use



pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$



initExp

getQuery

processAnswer

getModel



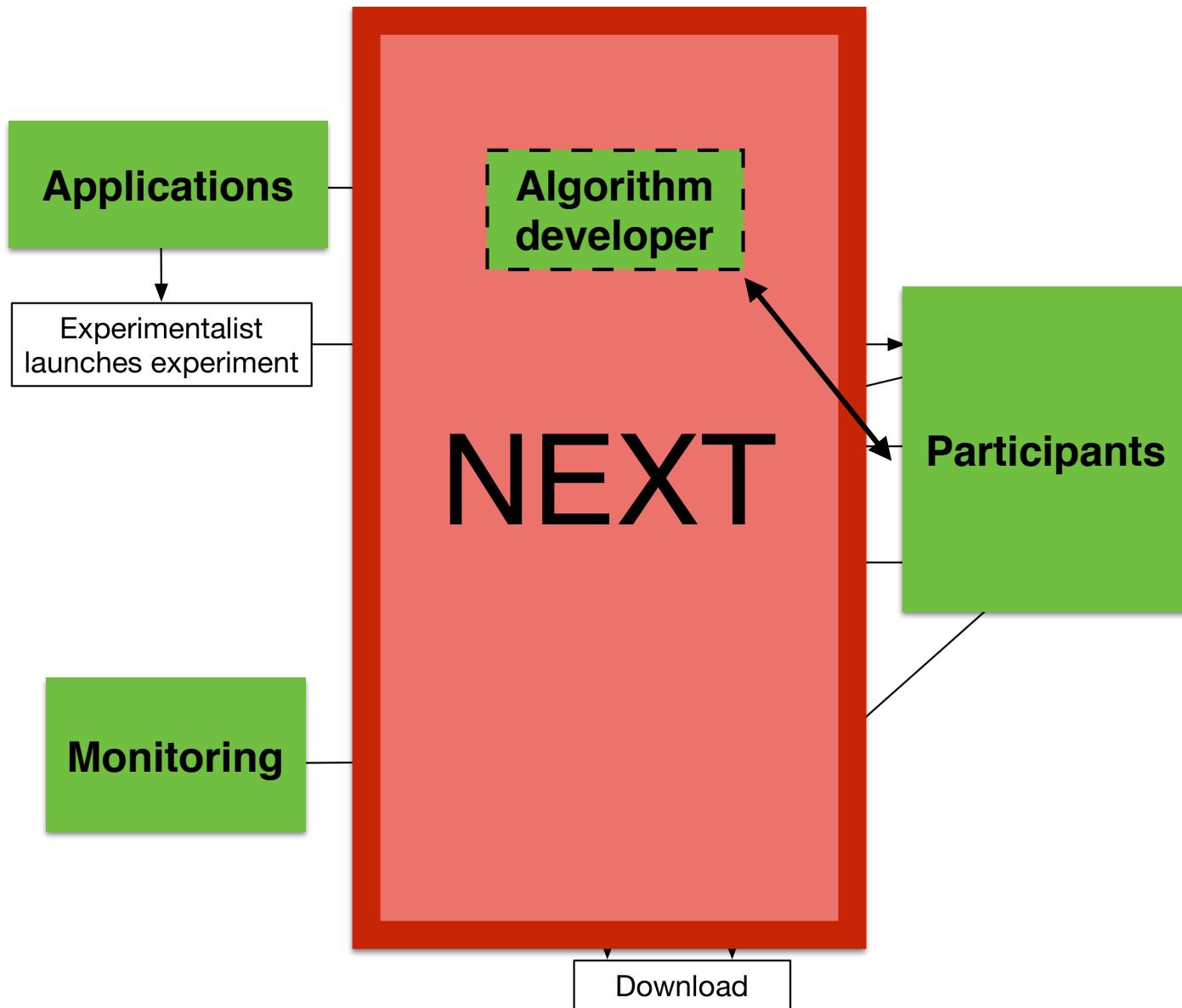
$$\Pr(|y - \hat{y}| < \epsilon) \leq 1 - \delta$$



Algorithm design decisions

1. Treat algorithms as black boxes
 - (for each function, inputs and outputs are documented and type-checked)
2. Use wrapper to allow easy access to experiment information and background jobs
3. Objects are abstracted to integers (i.e., object 42, not `{'filename': 'foo.png', 'url': ...}`)
(more detail in proceedings and on docs)

Algorithm use



Launching NEXT via Amazon EC2 AMI

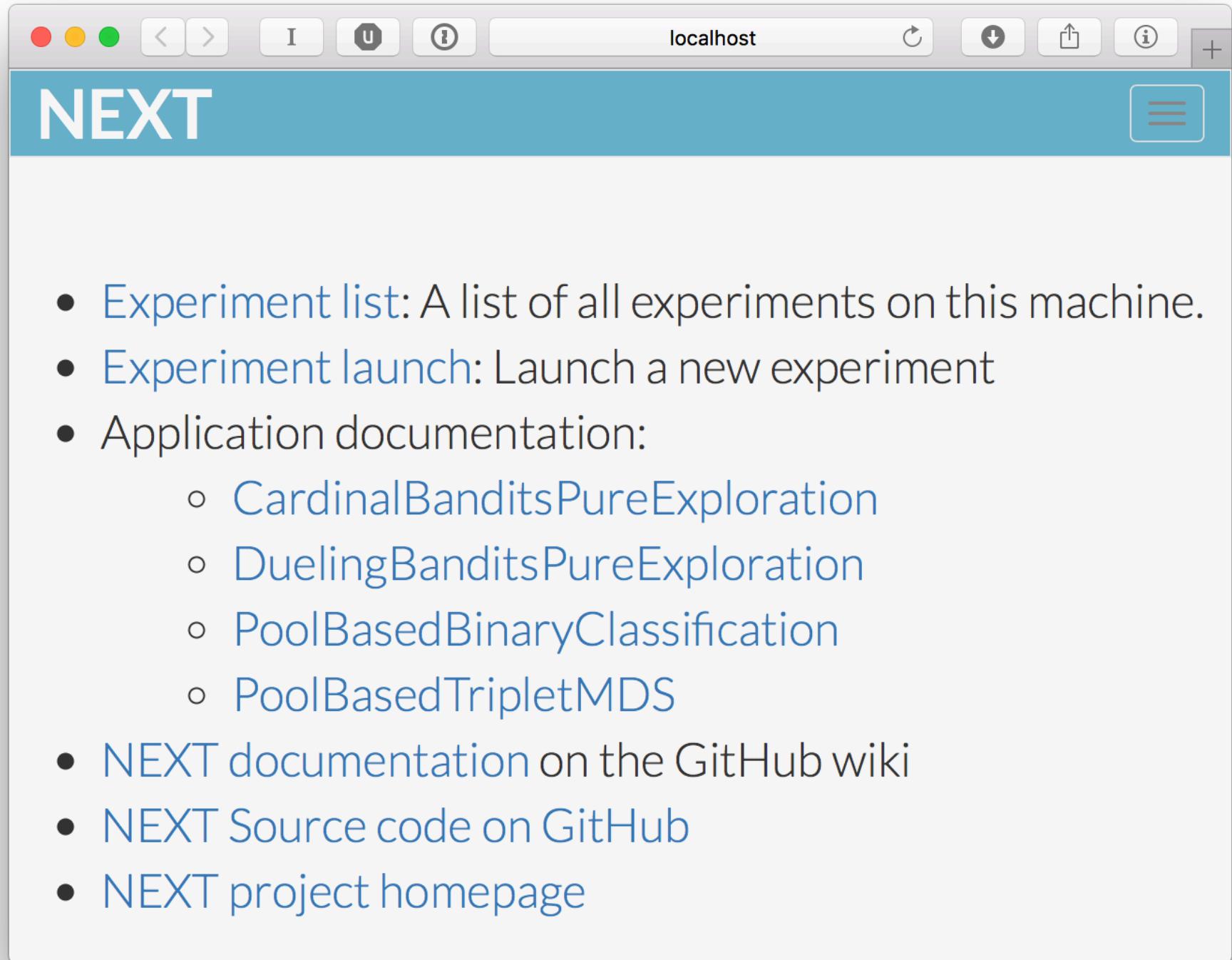
The screenshot shows the AWS EC2 Management Console interface. On the left, there's a navigation sidebar with sections like EC2 Dashboard, Instances, Images, Elastic Block Store, Network & Security, and Load Balancing. The main area is titled 'Resources' and displays a summary of EC2 resources in the US West (Oregon) region: 0 Running Instances, 0 Dedicated Hosts, 8 Volumes, 7 Key Pairs, 0 Placement Groups, 0 Elastic IPs, 2 Snapshots, 0 Load Balancers, and 142 Security Groups. Below this, a callout box suggests trying Amazon Lightsail for free. The central part of the screen is the 'Create Instance' section, which contains a large blue 'Launch Instance' button that is circled in red. To the right of the main content are several 'Account Attributes' and 'Additional Information' sections, as well as a 'AWS Marketplace' sidebar.

(more detail in proceedings
and on docs)

See <https://github.com/nextml/NEXT/wiki>
for details and more launching options

tinyurl.com/scipy-next

NEXT startup page



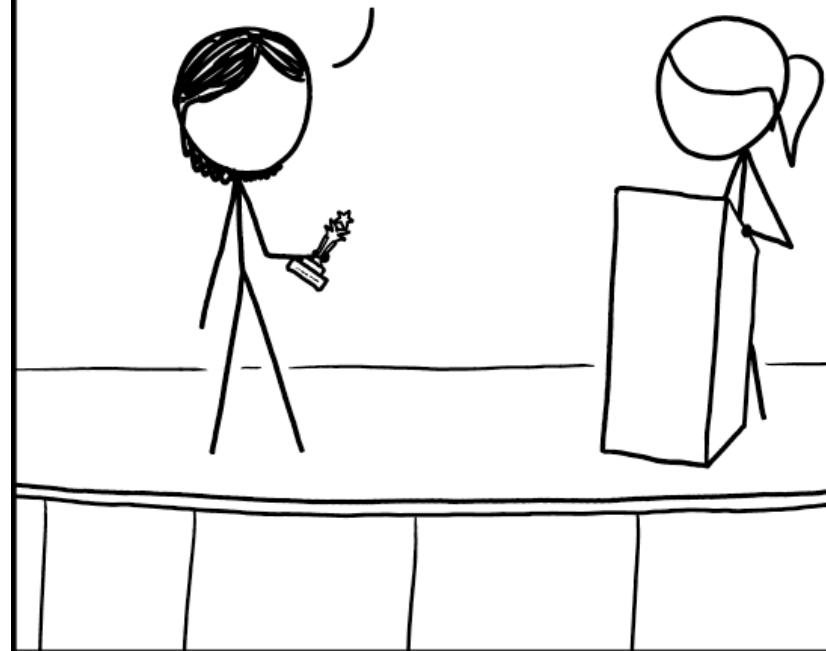
Key messages

1. Adaptive sampling reduces data collection cost.
2. NEXT is a crowdsourcing data collection tool that can use adaptive sampling techniques
3. NEXT is easy* to use by experimentalists, algorithm developers and practitioners, and a mathematical background is not required.
4. NEXT develops experimentalist engagement to aid research and to gain feedback to improve the software

I'D LIKE TO THANK MY DIRECTOR,
MY FRIENDS AND FAMILY, AND—
OF COURSE—THE WRITHING MASS
OF GUT BACTERIA INSIDE ME.

I MEAN, THERE'S LIKE ONE OR
TWO PINTS OF THEM IN HERE;
THEIR CELLS OUTNUMBER MINE!

ANYWAY, THIS WAS A
REAL TEAM EFFORT.



Extras...

Algorithm inputs and outputs

- Documented exactly in apps/[app-id]/algs/Algs.yaml

```
getQuery:  
  args:  
    participant_uid:  
      type: string  
      description: ID of the participant answering the query  
  rets:  
    description: The index of the target to ask about  
    type: num
```

- Function implementation

```
import random  
  
def getQuery(self, butler, participant_uid):  
    n = butler.algorithms.get(key='n')  
    return random.choice(n)
```

Depends on a library we developed:

<https://github.com/daniel3735928559/pijemont>

Adaptive data flow

- Fundamentally requires 4 functions:
 - **initExp**: experiment initialization
 - **getQuery**: selects query to present to participant
 - **processAnswer**: process participants response
 - **getModel**: provides experiment monitoring

