

The background image is a wide-angle, aerial photograph of the San Francisco skyline at night. The city is densely packed with buildings of various heights, all illuminated by their lights. In the distance, the Golden Gate Bridge is visible, its towers glowing against the dark sky. The overall atmosphere is one of a bustling, modern urban center.

The AI TestBot As A New Tool For Continuous Testing

Test Heads Dublin

August 27, 2019

 SAUCE LABS

COMPANY FACTSHEET



FOUNDED IN

2008

EMPLOYEES

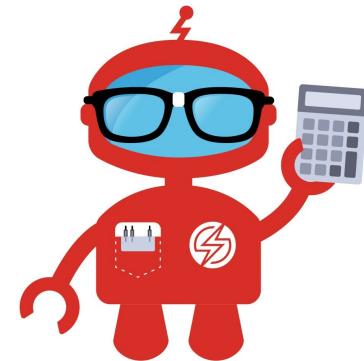
~~200+~~
3

TESTS RUN PER DAY

2.0m

ACTIVE CUSTOMERS

3,600



All the Saucers :-D



Things I do and what you can ask me



I work on reverse engineering iOS and figuring out
tricky problems with real devices. 😊

Obvs, I am passionate about automated testing 😊

I have two udacity NanoDegrees, one in ML and one
in DL. (Currently completing the third one)

My Goal Tonight



I hope everyone of you will learn
what Machine Learning is
how it is related to AI Test Bots
what you can do with these Bots
what you cannot do with these Bots

So, What Can it Do?



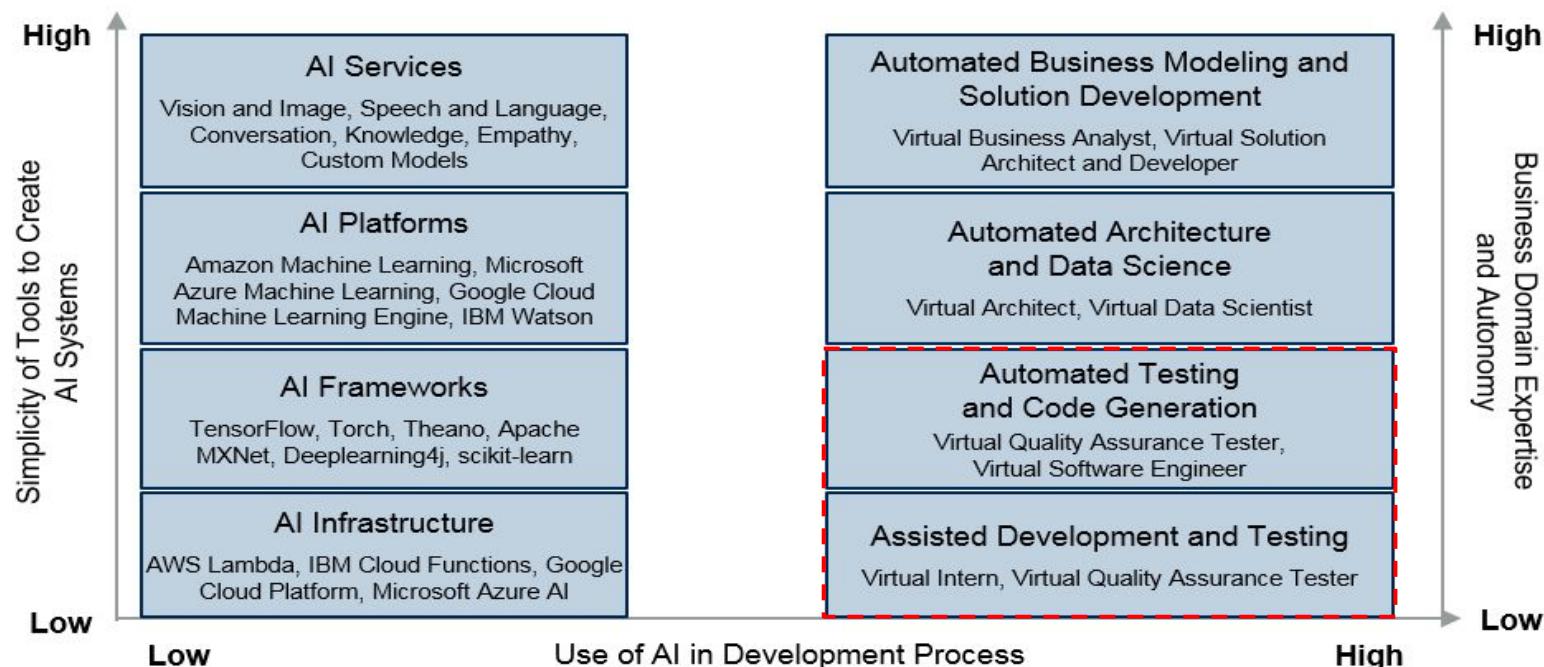


Overview of AI Testing

Gartner's prediction for Top IT Strategic Trends 2019: "Trend 3. AI Driven Development"

"By 2022, at least 40% of new projects will have AI co-developers on the team."

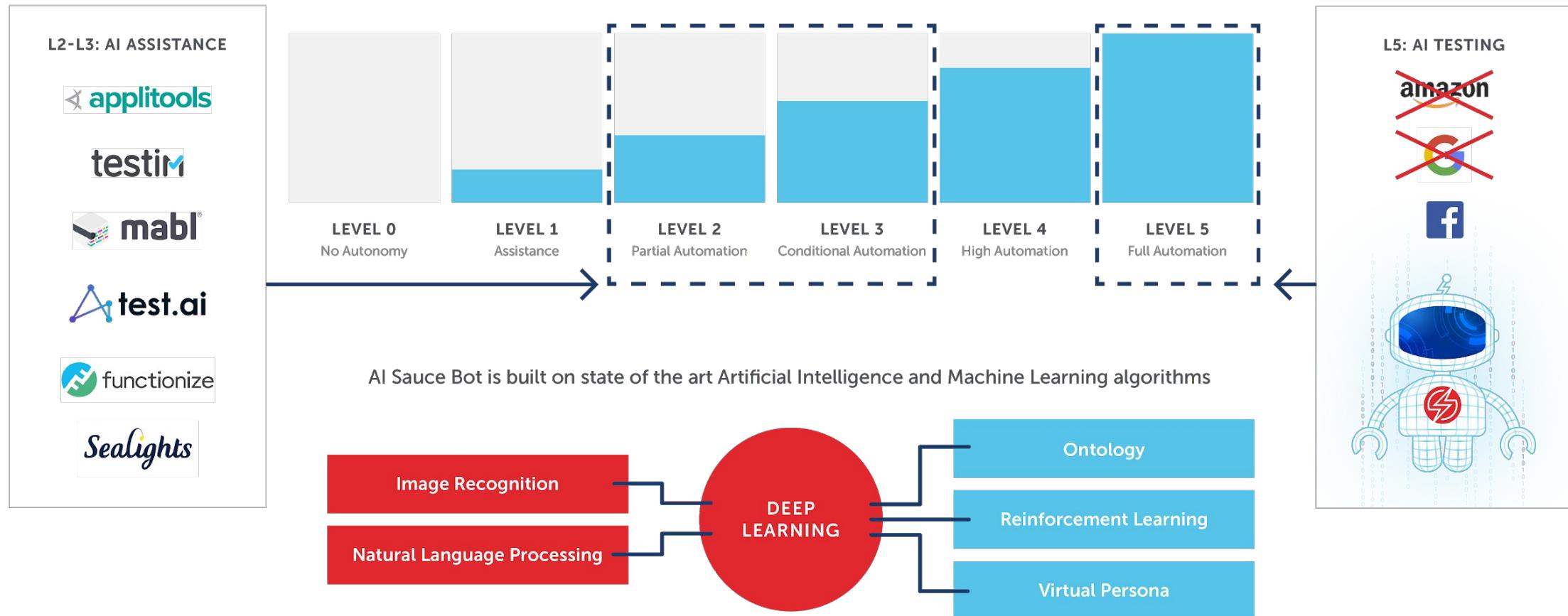
Applying Artificial Intelligence to the Development Process





Overview of AI Testing

How autonomous is your testing solution?





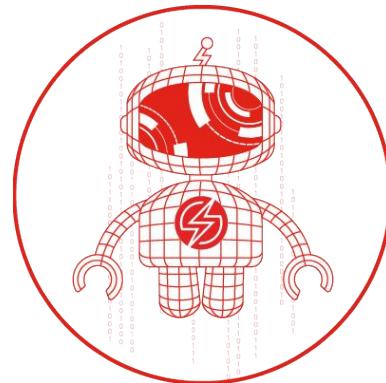
Introducing AI Sauce Bot (*code name*)

AI Sauce Bot is the testing autopilot for your mobile app

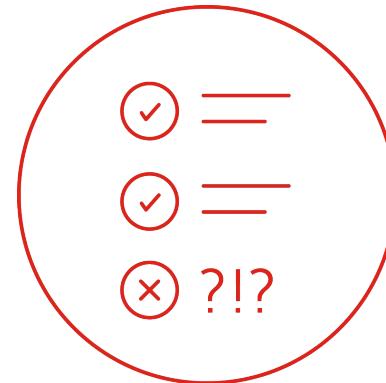
Within few minutes, AI Sauce Bot automatically tests your app against hundreds of devices



1. Upload app



2. Test on 100s devices



3. Get Results in 30 min

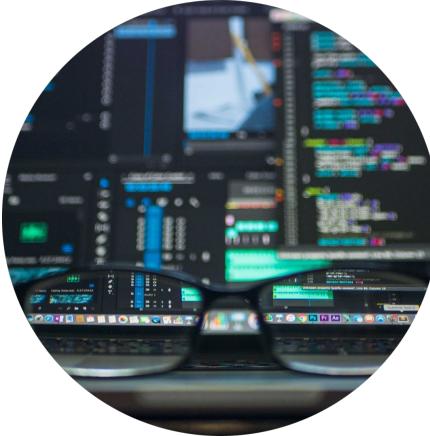
Why do you need AI Testing?



Can my app be tested everyday?



Hell No!



Maybe?!?!



AI Sauce Bot!

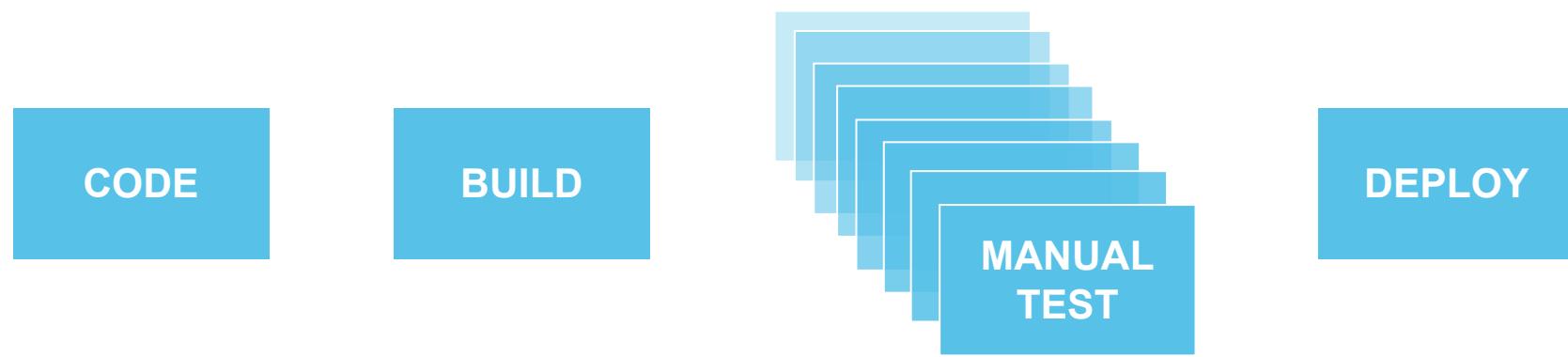
- ✓ **Done!**
- ✓ **Yes**
- ✓ **Give me more!**
- ✓ **Yes**
- ✓ **Done!**
- ✓ **Yes**



Why do you need AI Sauce Bot?

Can my app be tested everyday? On every build?!?

Conventional **Manual** Functional Testing



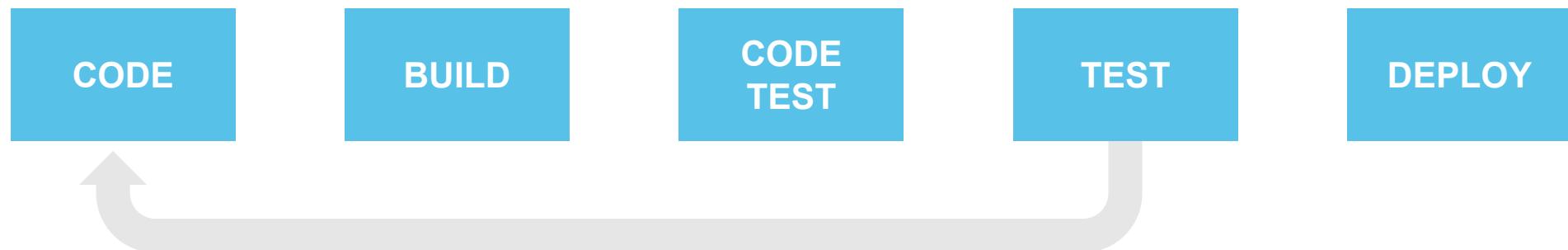
Inconsistent and overly time consuming testing experience



Why do you need AI Sauce Bot?

Can my app be tested everyday? On every build?!?

Conventional **Automated** Functional Testing



Time consuming and requires automation development expertise

Why do you need AI Sauce Bot?



Can my app be tested everyday? On every build?!?

Continuous Testing using AI Sauce Bot

Codeless, AI based, continuous automated testing. Zero knowledge required.



Detect issues much earlier in the pipeline. Zero code and efforts required.

Why do you need AI Sauce Bot?



Look ma, no hands!

AI Sauce Bot is extremely smart. Practically, you do nothing!

It really finds errors

It finds errors you can hardly reach and dream of

Efficient and Fast

App quality reporting across 100+ devices [will be ready in 30 min or less](#)

Codeless Automation

Supplement functional testing with codeless exception detection

Continuous Testing

AI Sauce Bot takes your organization to Continuous Testing with zero effort:
code → build → AI Sauce Bot → code → build → AI Sauce Bot → release



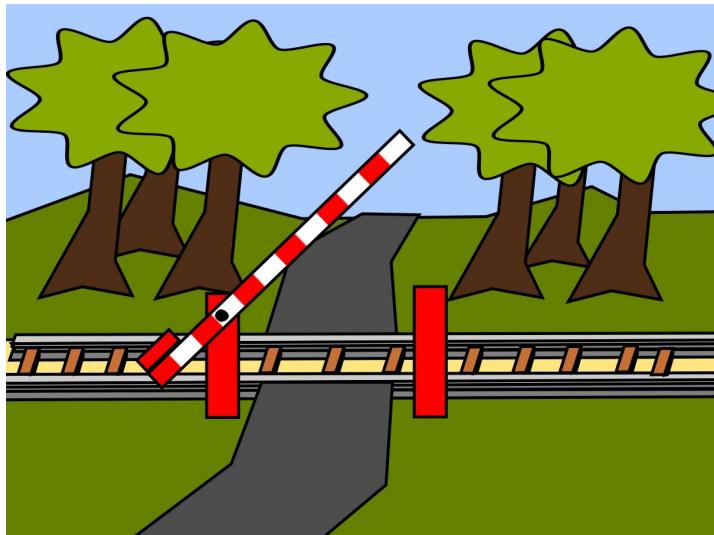
And now, how does it work?
(ML Basics or TestBot)



ML Basics Explained My Way

Key concepts of an algorithm

Domain



Jane (Developer)

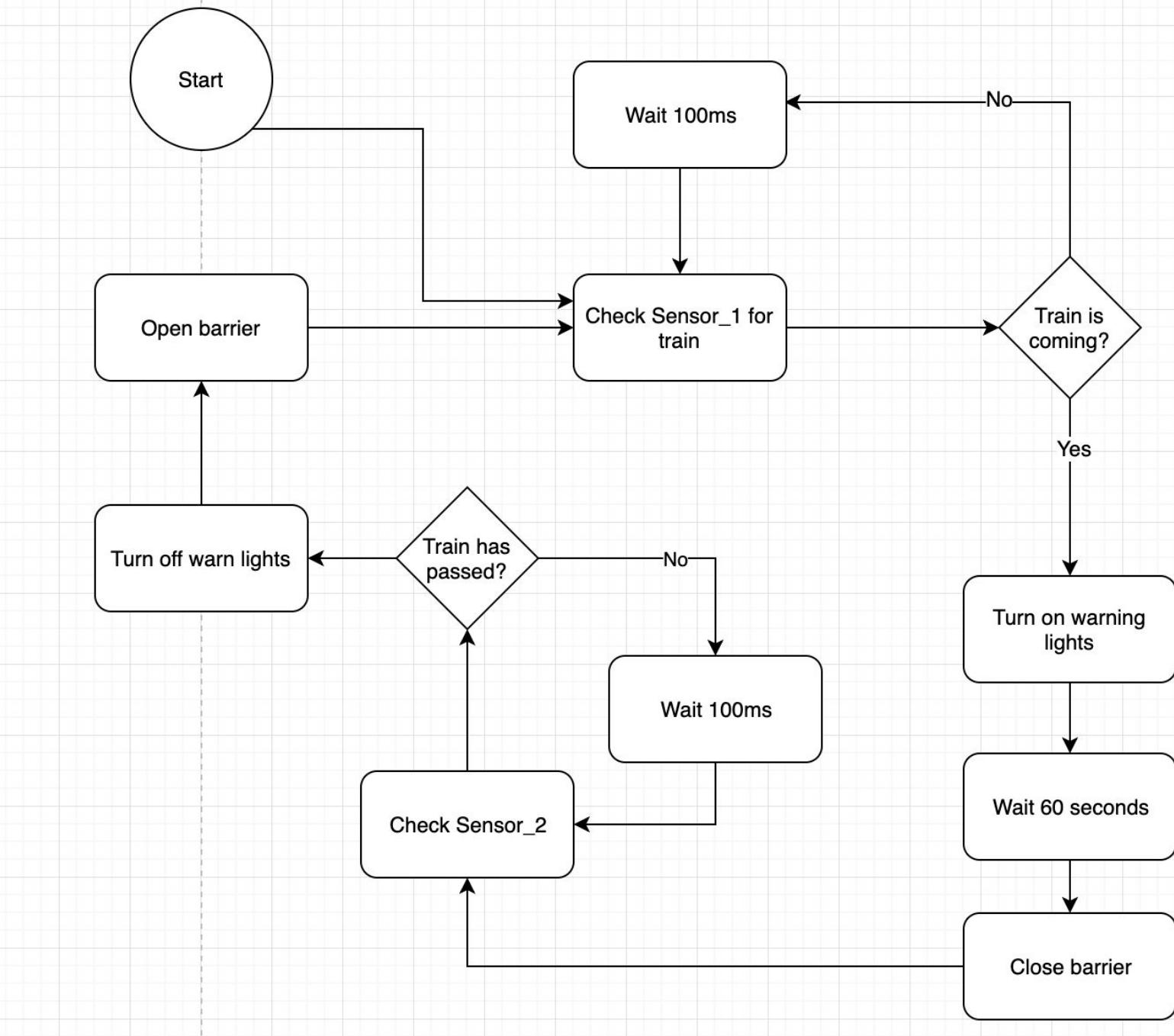


Sequence of Steps





An algorithm is
born..



Algorithms

Good things:

They usually give you 100% accuracy

Example Domains: Automated Testing
;-) , Tax declarations, Control systems
for trains

Bad things:

Hard to figure out

Development is an error prone process

Case Study - Test Automation for Shopping App

Domain, Shopping App and it's features

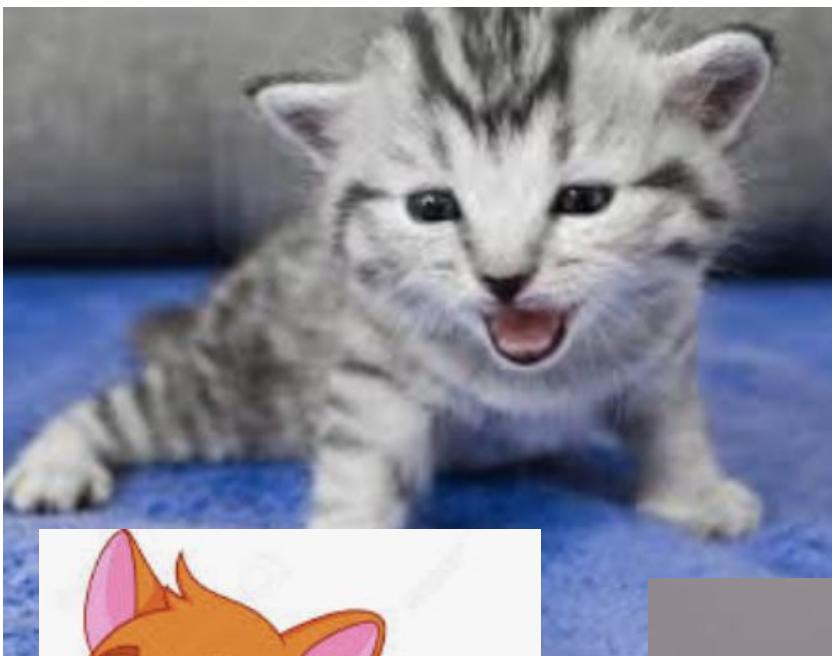
Task, build a functional test to verify searching for products works.

Series of steps:

1. Find the TextField for searching
2. Enter “Ketchup”
3. Click “Search”
4. Wait a bit
5. Check if the list of results contains “Heinz Ketchup”



Ok let us try and build an algorithm for finding cats!



What Jane needs..

Jane needs an algorithm that can take a set of examples, find the pattern in the data on its own, and then classify images correctly.

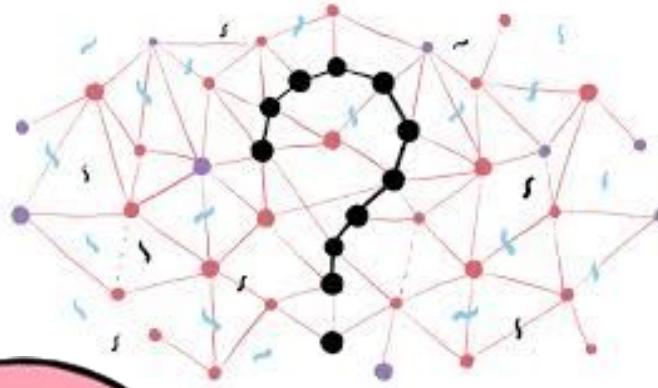


So what is A.I. then?

Domain

3	4	2	1	9	5	6	2	1	8
8	9	1	2	5	0	0	6	6	4
6	7	0	1	6	3	6	3	7	0
3	7	7	9	4	6	6	1	8	2
2	9	3	4	3	9	8	7	2	5
1	5	9	8	3	6	5	7	2	3
9	3	1	9	1	5	8	0	8	4
5	6	2	6	8	5	8	8	9	9
3	7	7	0	9	4	8	5	4	3
7	9	6	4	7	0	6	9	2	3

Algorithm



Trained Algorithm

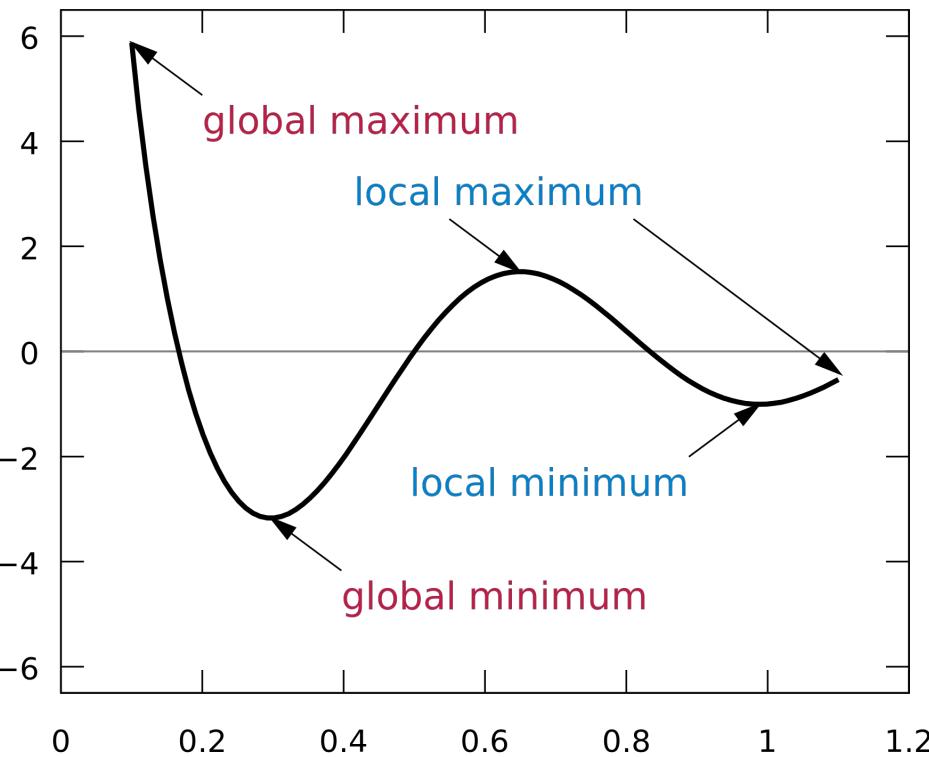
$$\text{Blurred Image} = 1$$

$$\text{Clear Image} = 1$$

$$\text{Blurred Image} = 5$$

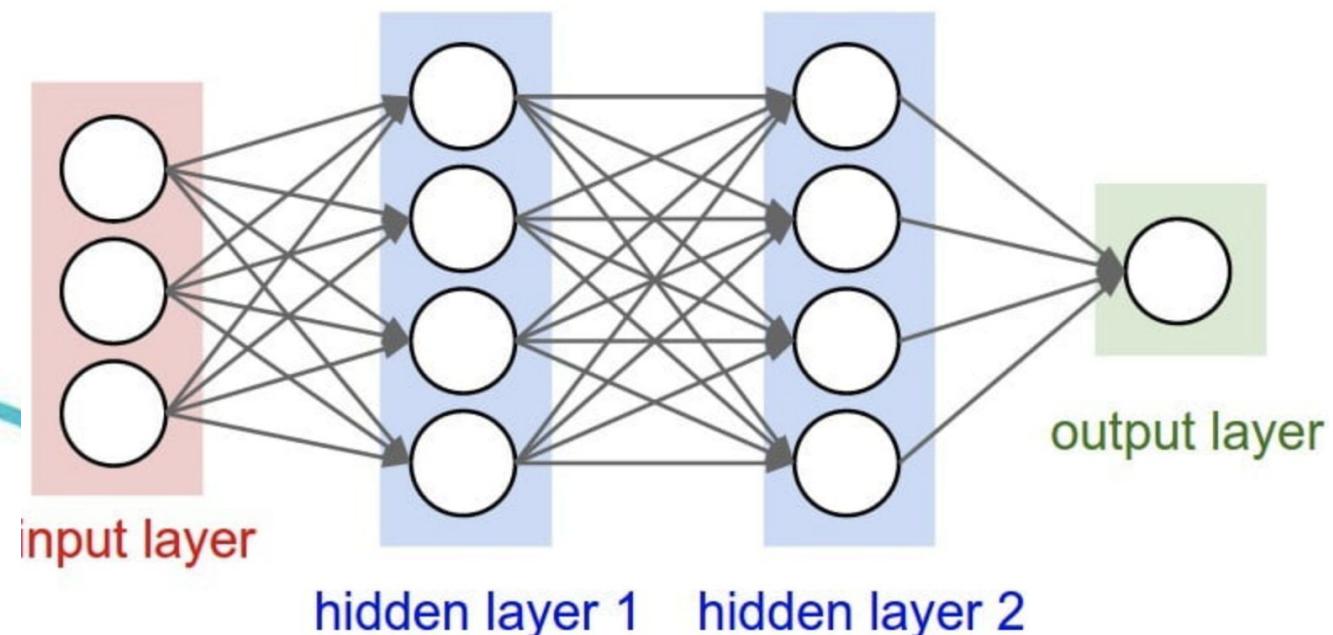
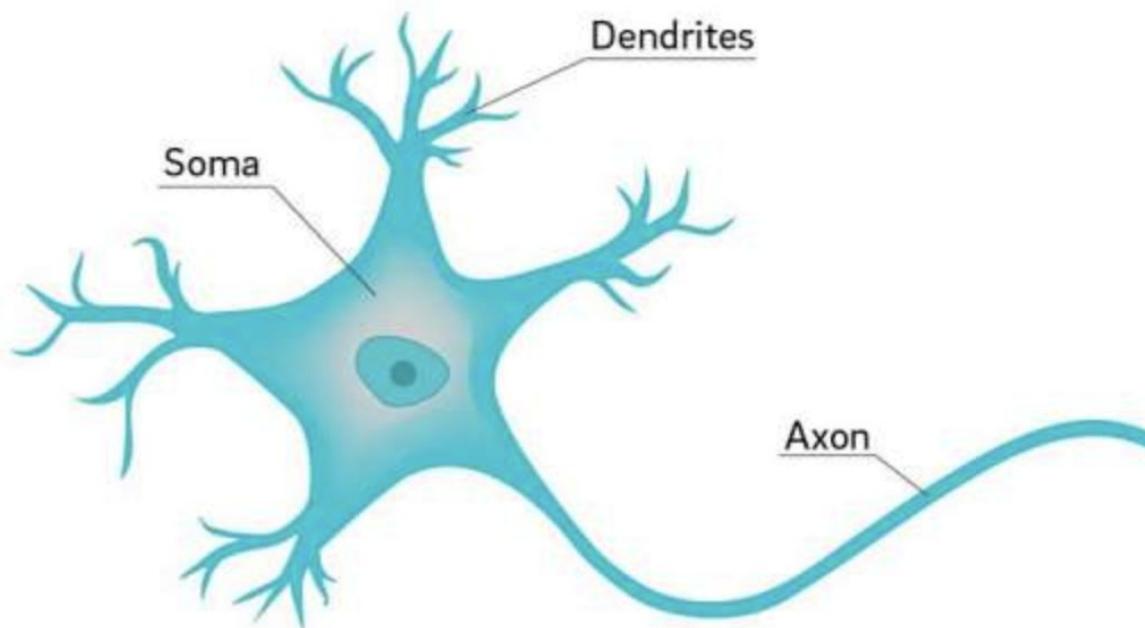
How does Learning work?

AI as we know it today, was invented in the 60s. The core technology is still exactly the same: Backpropagation and gradient descent



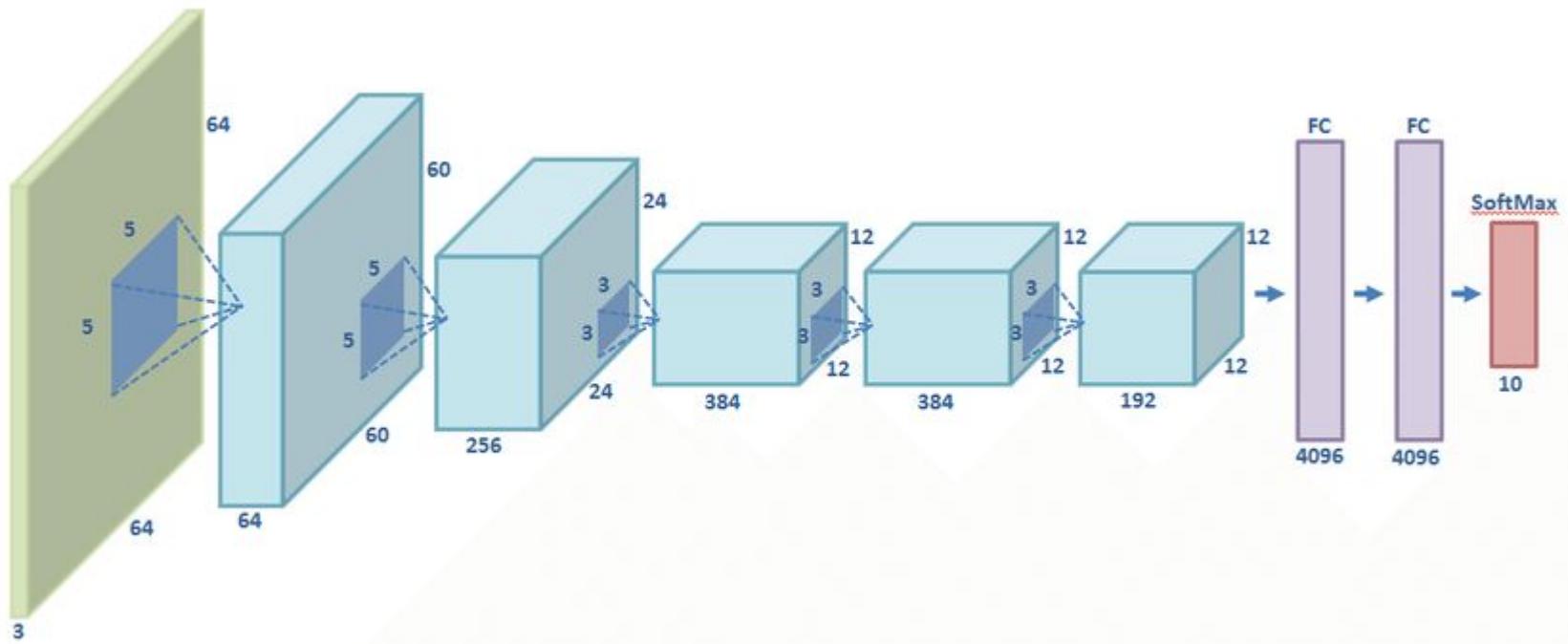
What are neural networks?

Neuron



What is Deep Learning?

(https://www.researchgate.net/figure/Scheme-of-the-AlexNet-network-used_fig1_320052364)



There is a ton of other ML algorithms

- Reinforcement Learning, train an algorithm like an animal by rewarding or punishing actions
- Evolutionary Algorithms, train an algorithm with random mutations and a fitness function
- State Vector Machines and many more

If it is so easy, will Jane be unemployed now?

No she won't, because building and tuning A.I. algorithms is hard and oftentimes needs a lot of domain knowledge, too..

She should consider A.I./ML algorithms as useful tools that make her more efficient!



ML As Data Driven Engineering - Recap

Whenever we have a huge amount of data

Clear correlation or pattern in the data

Classification of unclear, non formal data like text, images or sound

100% Accuracy, with an explanation, is not strictly required



And now, how does it work?
TestBot



What is a Bot?

Wikipedia puts it quite nicely:

a bot is a complex software entity that is capable of acting with a certain degree of autonomy in order to accomplish tasks on behalf of its host - That tells us something about the relationship with ML algorithms



Actually We Mean A Bot Assisting with Exploratory Testing

- There are a lot of different methods for it
- They more or less face the same issues but solve them differently
- Some of them use ML/AI to improve the quality of the solution, others don't



Example 1 - Monkey Testing

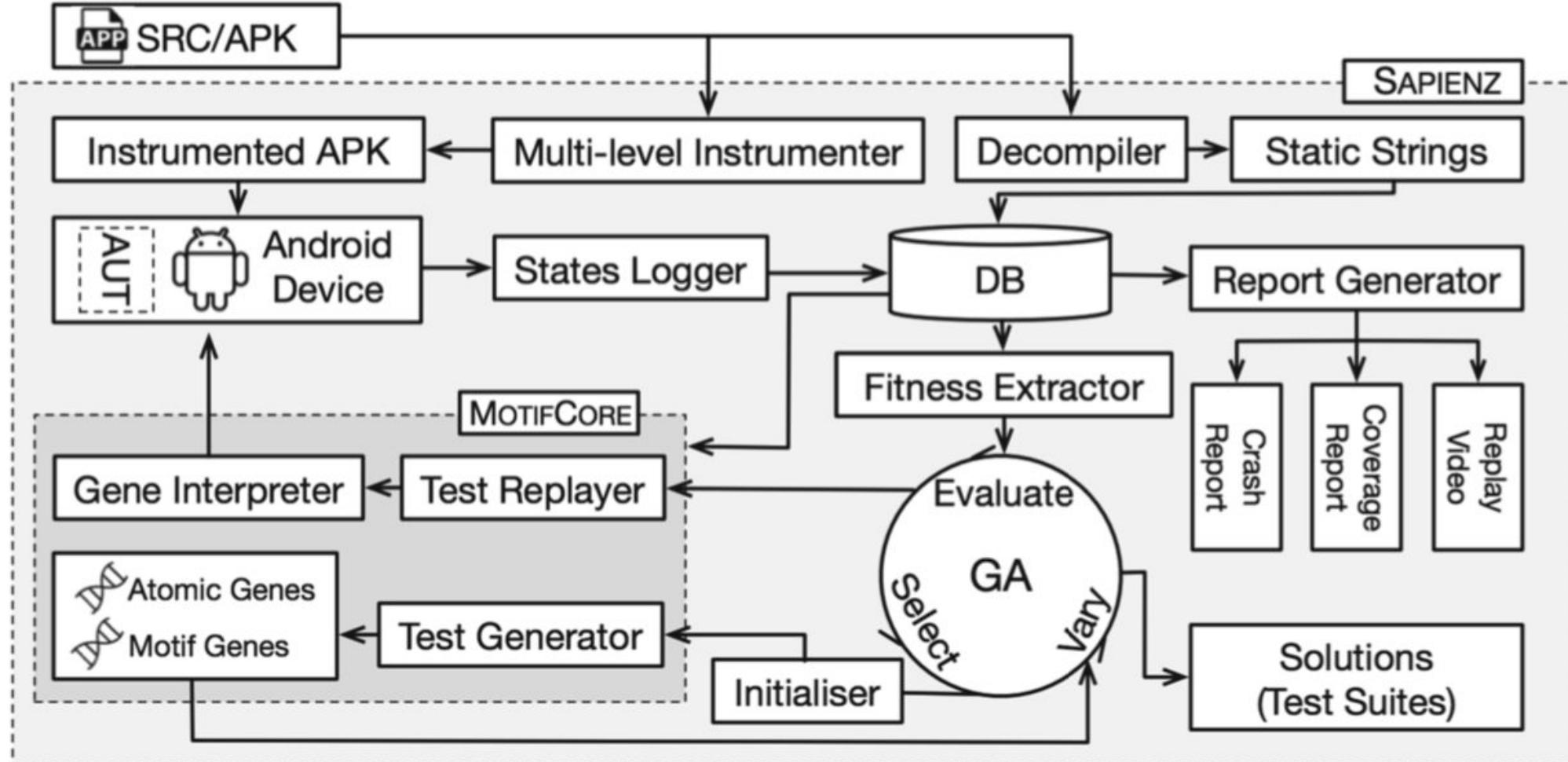
Explore the app by randomly clicking things without any real strategy

(Some services add smart features, like the ones we will see later on)





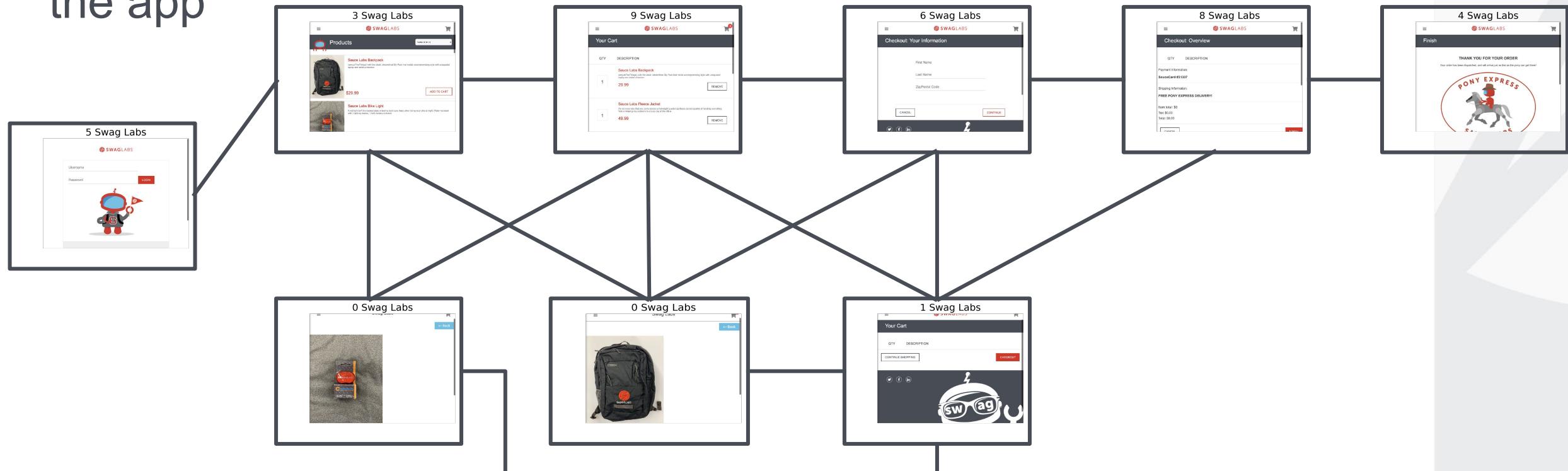
Example 2 - Facebook Sapienz





Build an Internal Representation of the App

By using atomic actions or combinations of actions like “fill out all fields of a form and hit submit”, randomly or structured, explore the app





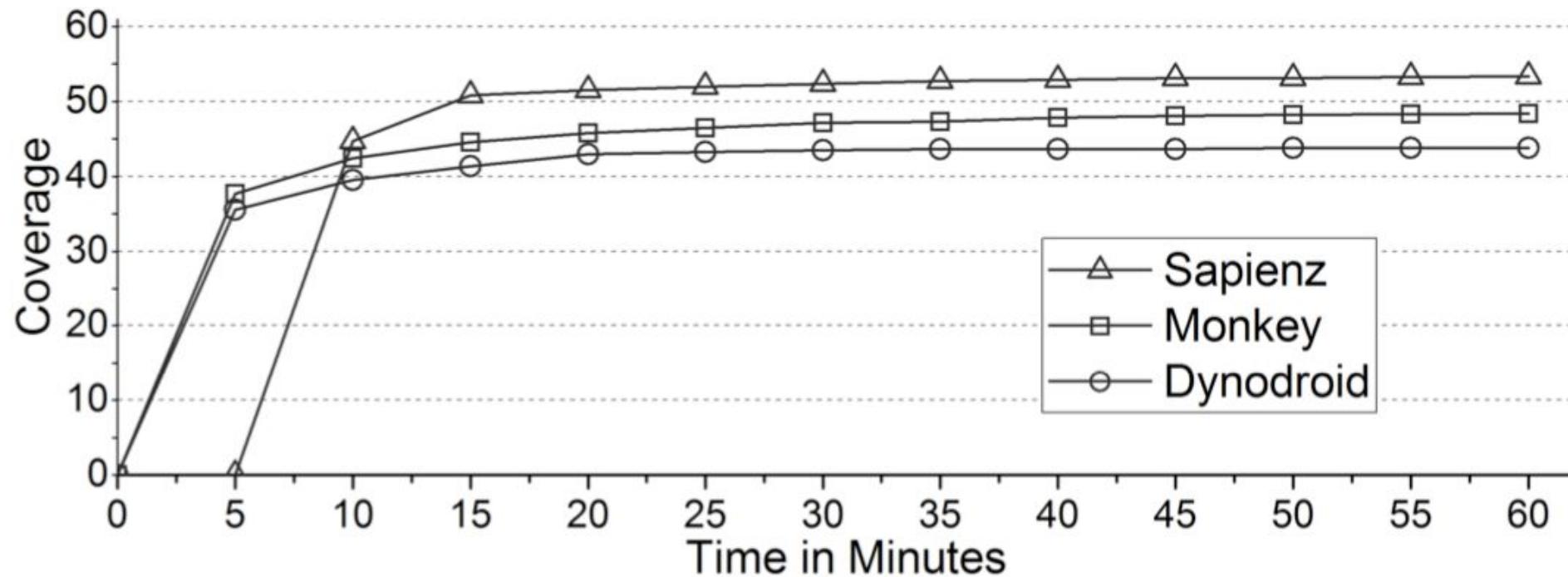
Build an Internal Representation of the App

- Usually this is a mix of conventional algorithms and ML/AI components
- Facebook's Sapienz f.ex. uses evolutionary algorithms for optimizing what is a rather conventional algorithm for coverage
- Monkey testing uses random actions
- SauceBot uses RL



A Metric to Evaluate Performance of a TestBot

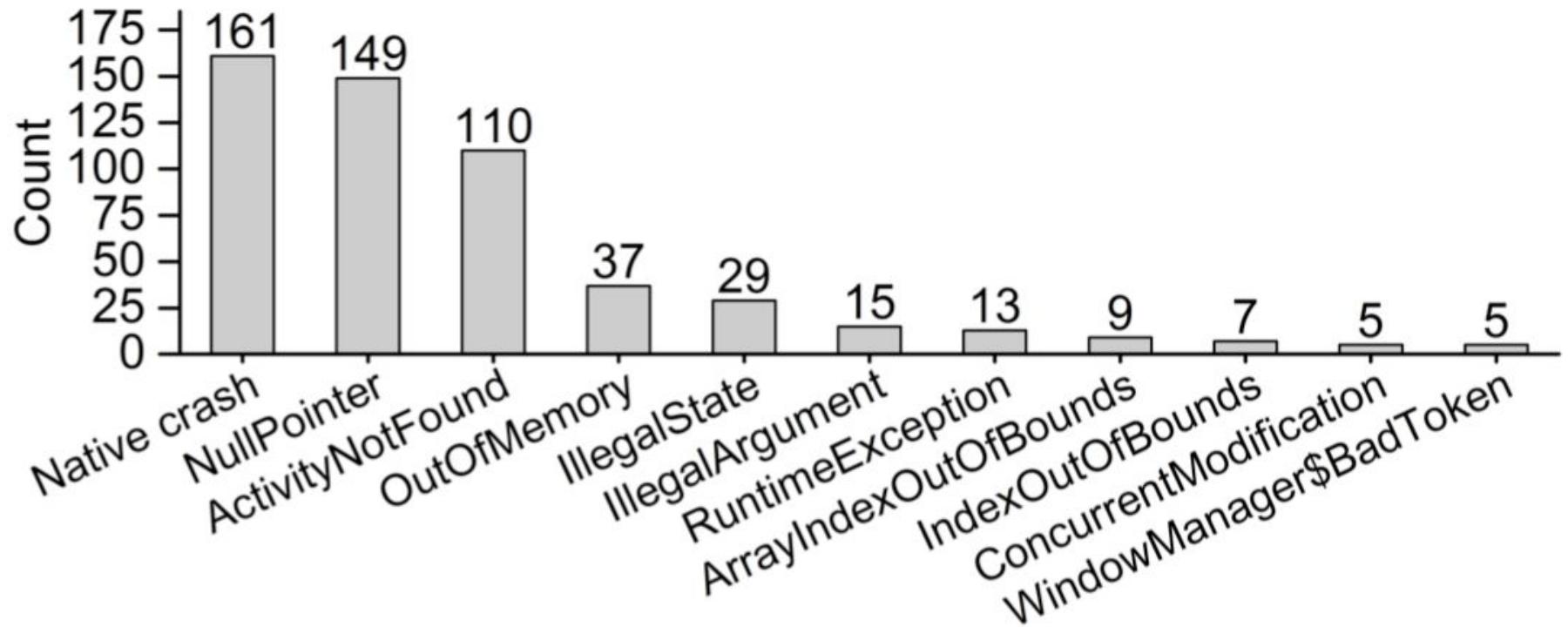
'skin coverage' as the reward function





What Kind of Errors Will be Found?

Examples from the Facebook Sapienz Paper





What Kind of Errors Will be Found?

Examples from the Facebook Sapienz Paper

Table 6: Confirmed app faults identified by Sapienz.

App	Category	Installs	Caused By	Device	Description	Fixed
P*	Photography	10M-50M	NullPointerException	Nexus 7	Unable to start activity from a customer support SDK.	Unconfirmed
K*	Simulation	10M-50M	NullPointerException	Nexus 7	Concurrent error while executing doInBackground()	Unconfirmed
B*	Business	10K-50K	NullPointerException	Nexus 7	Null object reference in a third party SDK	No
D*	Education	500K-1M	NullPointerException	Emulator	Exception from event handler onOptionsMenuSelected()	Confirmed
T*	Simulation	10K-50K	NullPointerException	Emulator	Exception from onAnimationEnd() in FlipGameActivity	Confirmed
T*	Lifestyle	500K-1M	NullPointerException	Emulator	Error when CameraUpdateFactory is not initialized	Confirmed
T*	Transport	1M-5M	NullPointerException	Emulator	Exception from onClick() in StationInfoFragment	Confirmed
S*	Education	1M-5M	NullPointerException	Emulator	Unable to start a third party activity	Unconfirmed
T*	Weather	10M-50M	NullPointerException	Emulator	Error when CameraUpdateFactory is not initialized	Unconfirmed
W*	Weather	10K-50K	OutOfMemoryError	Note II	Error inflating class on binary XML file	Unconfirmed
S*	Puzzle	5M-10M	ActivityNotFoundException	Note II	No Activity found to handle SHARE_Google Intent.	Unconfirmed
F*	Photography	10M-50M	NullPointerException	Note II	Exception from onGlobalLayout() in ViewUtil	Confirmed
T*	Music&Audio	100M-500M	NullPointerException	Note II	Unable to start the activity of PlayerActivity	Unconfirmed
P*	Music&Audio	5K-10K	ActivityNotFoundException	Note II	No Activity found to handle a View Intent	Confirmed



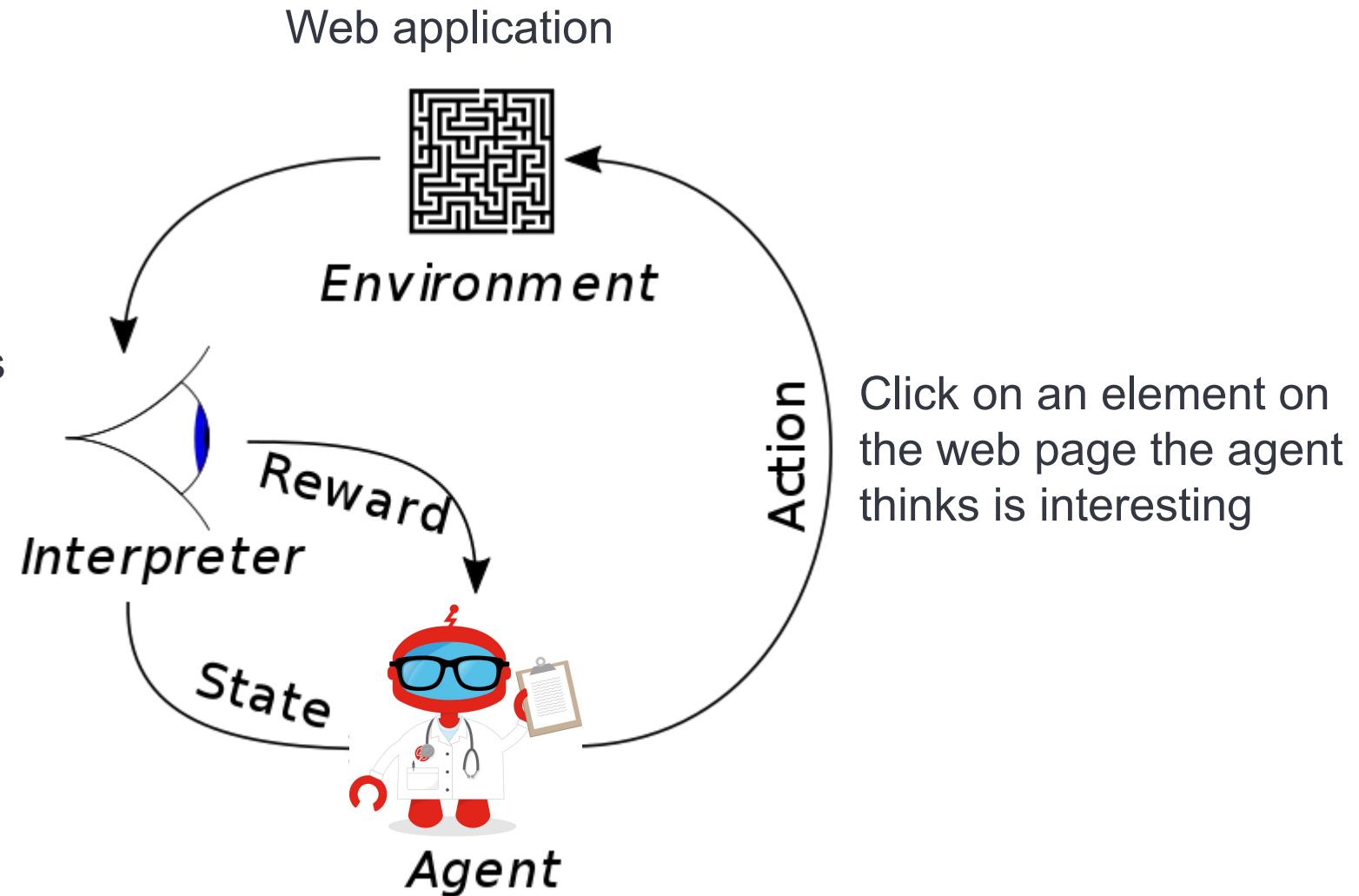
Training AI to explore an application - Reinforcement Learning

Did the action taken do something interesting?

- Change page attributes or add new elements?

What does the new state look like?

- Did the URL change?
- What elements on the page changed?



SauceBot - Exploration

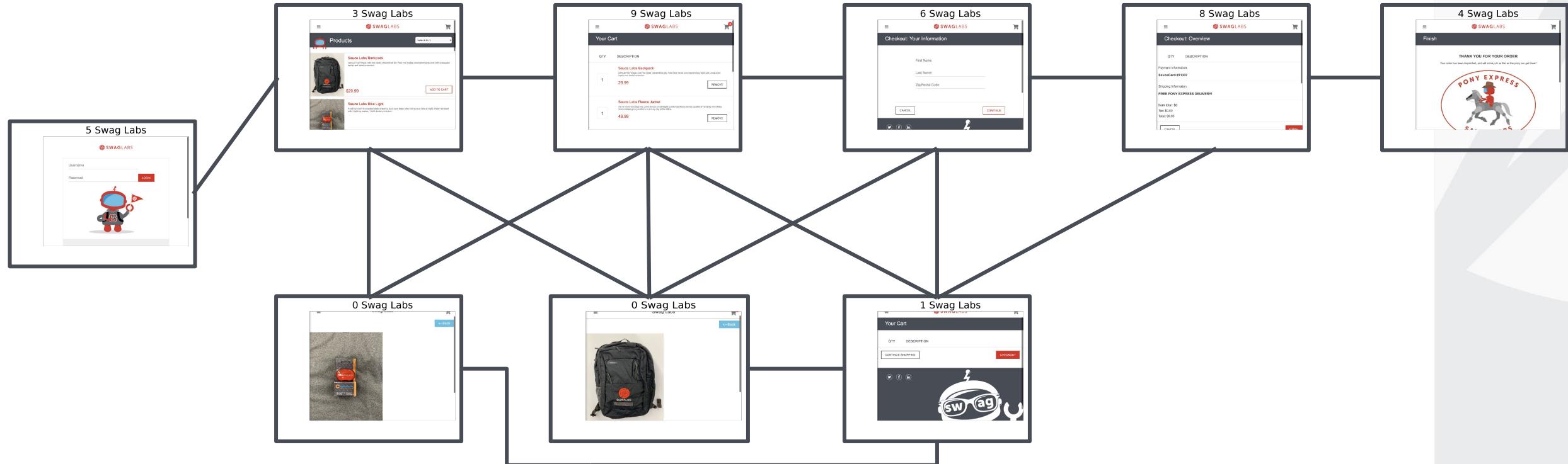


Sauce Bot explores the application, looking for novel states worthy of testing

It may appear random, but the bot is drawn to unique states

Through this exploration, it will remember how to navigate to each state

but **how to log in and checkout(?)**



AI Testbots General Limitations



- All the A.I. bot solutions have no real way of functional testing
- Non Input related state is hard to add (Logins, Photos, Mocks etc)

IMHO: Using ML techniques, it is probably possible to achieve better results in the upcoming years but just like autonomous driving, building these things is a lot harder than some vendors suggest

Now, I'd like to hear what
you think about TestBots
and the Presentation

