AI and Machine Learning For Testers

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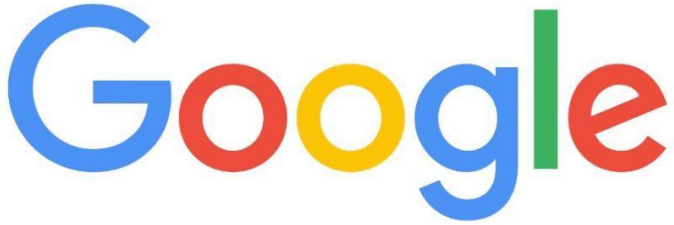
Android Emulator - Nexus5:5554
5:28
OfferUp
buy. sell. simple.
carbon — adb • test_ai — 97×38
test.ai Version:0.8.3
test.ai Version Note:Address user feedback issues. Performance improvements.
Add test case expansion. Add OCR to bot brain.
Refactor file storage layout (~/carbon -> ~/test_ai).
Fix verification issues. Labeler syntax searching.
By your command.
CARBON Main Menu:
0. Exit
1. Explore/crawl an app build
2. Start the Labeler UI web server
3. Run regressions on an app build
4. Upload an app build to the cloud
5. Download an app build locally
6. Clean the crawled app builds list
What would you like to do? 1
Path to app file: ~/Downloads/OfferUp.apk
emulator: ### WARNING: /etc/localtime does not point to /usr/share/zoneinfo/, can't determine zon
einfo timezone name
Success
test.ai

Relevant Context

Testing Neural Net Ranker



Personalized Web Search and
Chrome Test Automation

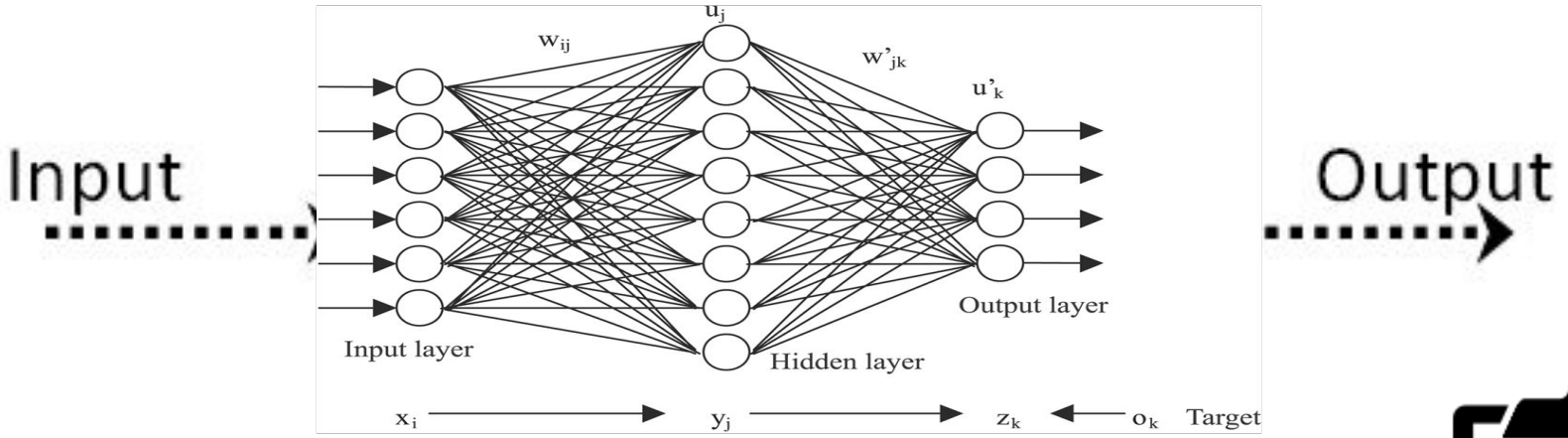
AI for Mobile Test Automation

AITesting.org

AIST
AiSUMMIT GUILD

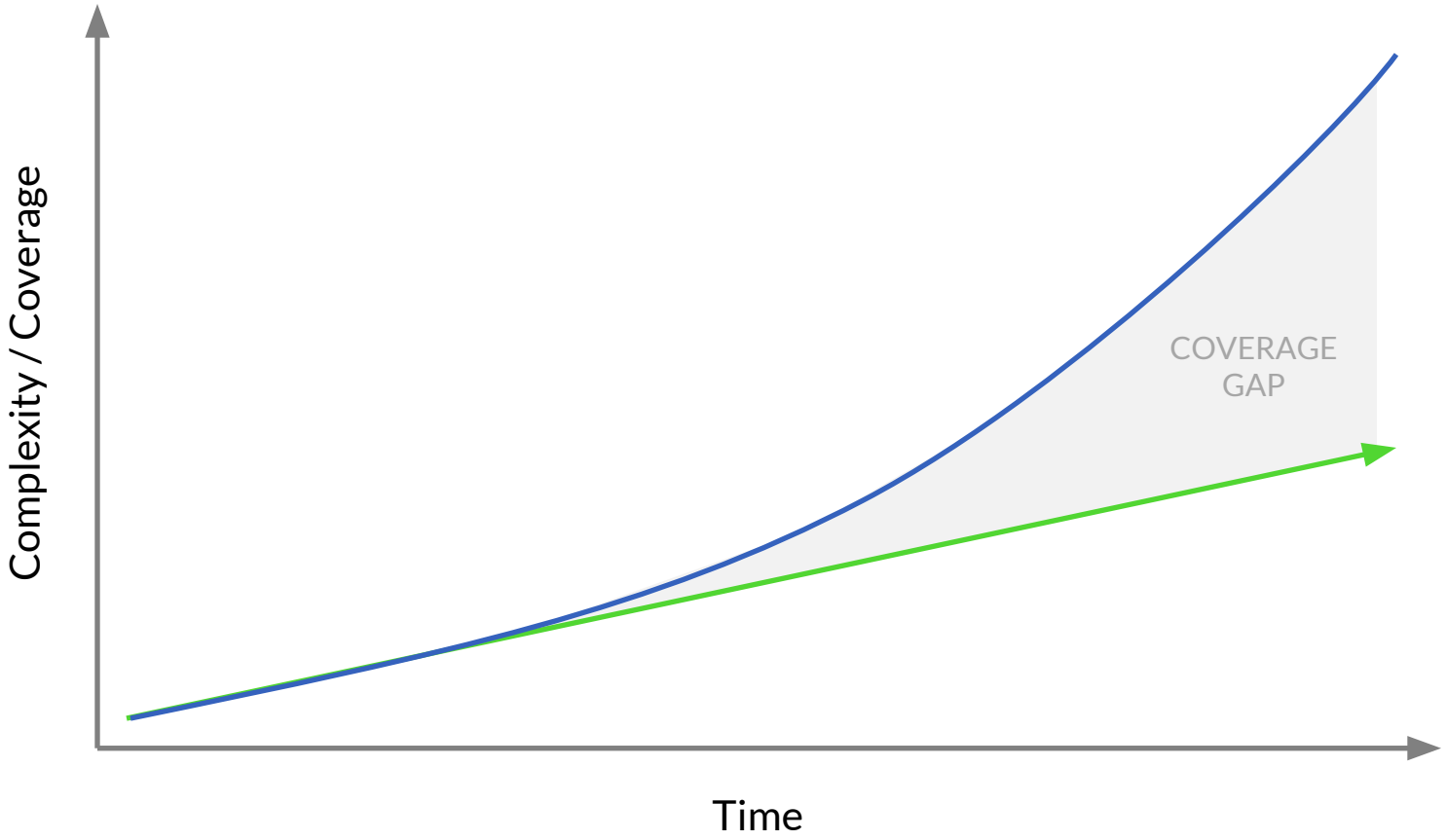
Testing: Apply Inputs, checking outputs.

AI: Apply Inputs, check outputs



https://www.extremetech.com/extreme/215170-artificial-neural-networks-are-changing-the-world-what-are-they

Testing Needs AI



Features

Complexity increases exponentially as new features and states interact with existing features

Tests

Test coverage grows linearly because tests can only be added one at a time

Definition of ARTIFICIAL INTELLIGENCE

1 : a branch of computer science dealing with the simulation of intelligent behavior in computers

2 : the capability of a machine to imitate intelligent human behavior

HOW A BOT LEARNS TO TAP, TYPE, AND SWIPE

PERCEIVE

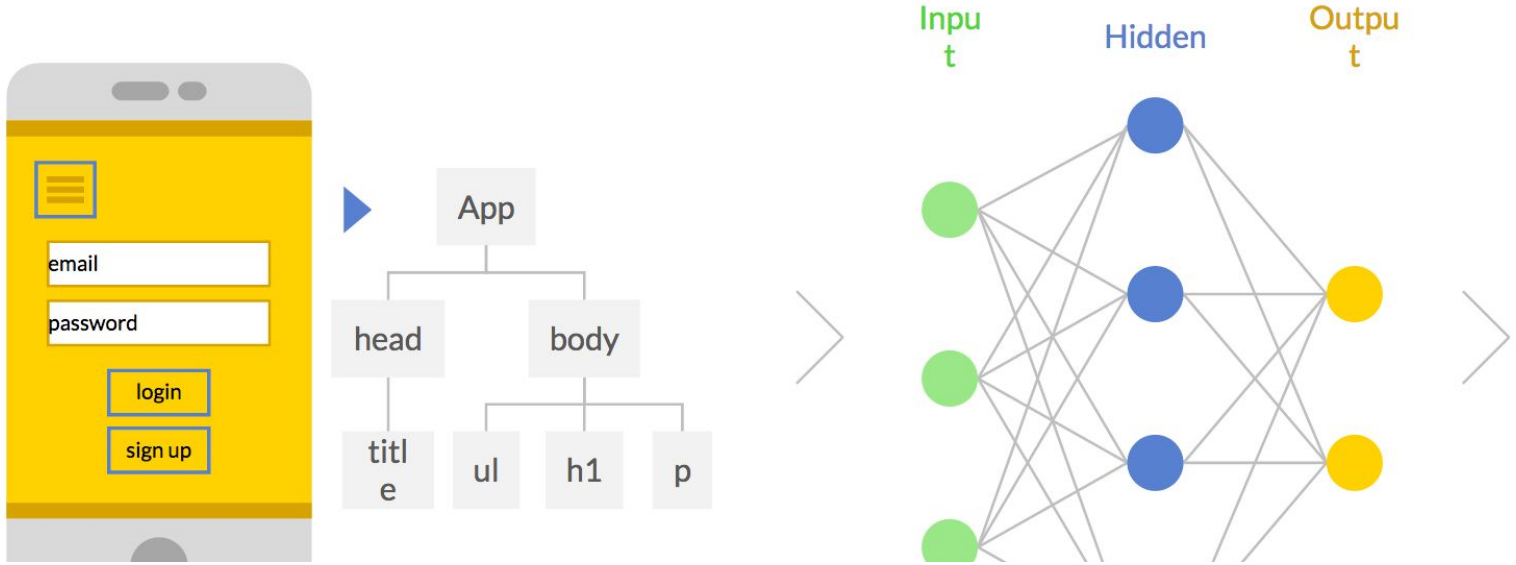
"What can we interact with?"

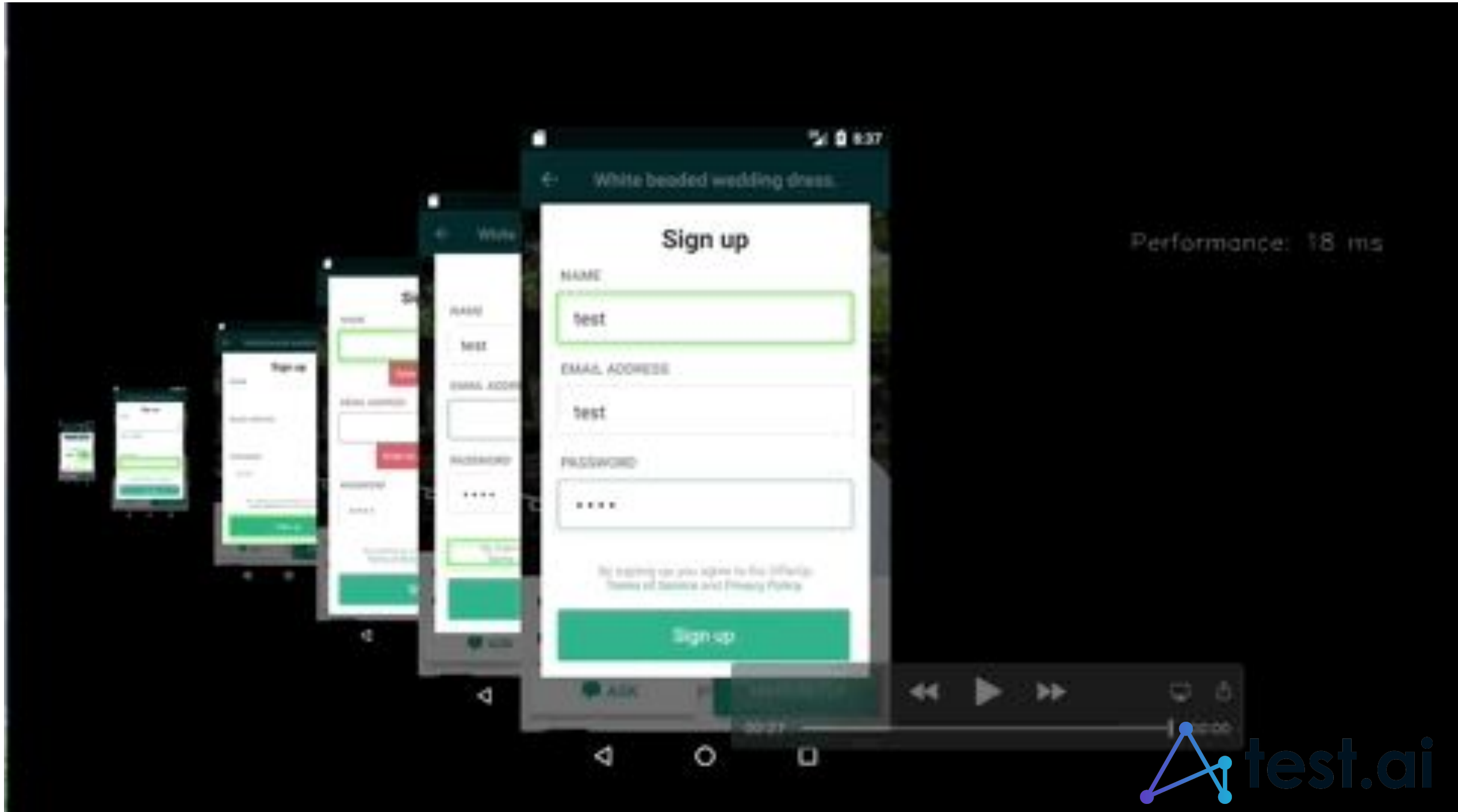
ACT

Neural network determines what action to take

LEARN

Each action contributes to training brain




Performance: 18 ms
White beaded wedding dress
Sign up
NAME
test
EMAIL ADDRESS
test
PASSWORD
Sign up
test.ai

Key Problems in Test Automation

1. Have to Code
2. Element Selection
3. Test Step Sequencing

solved by AI systems

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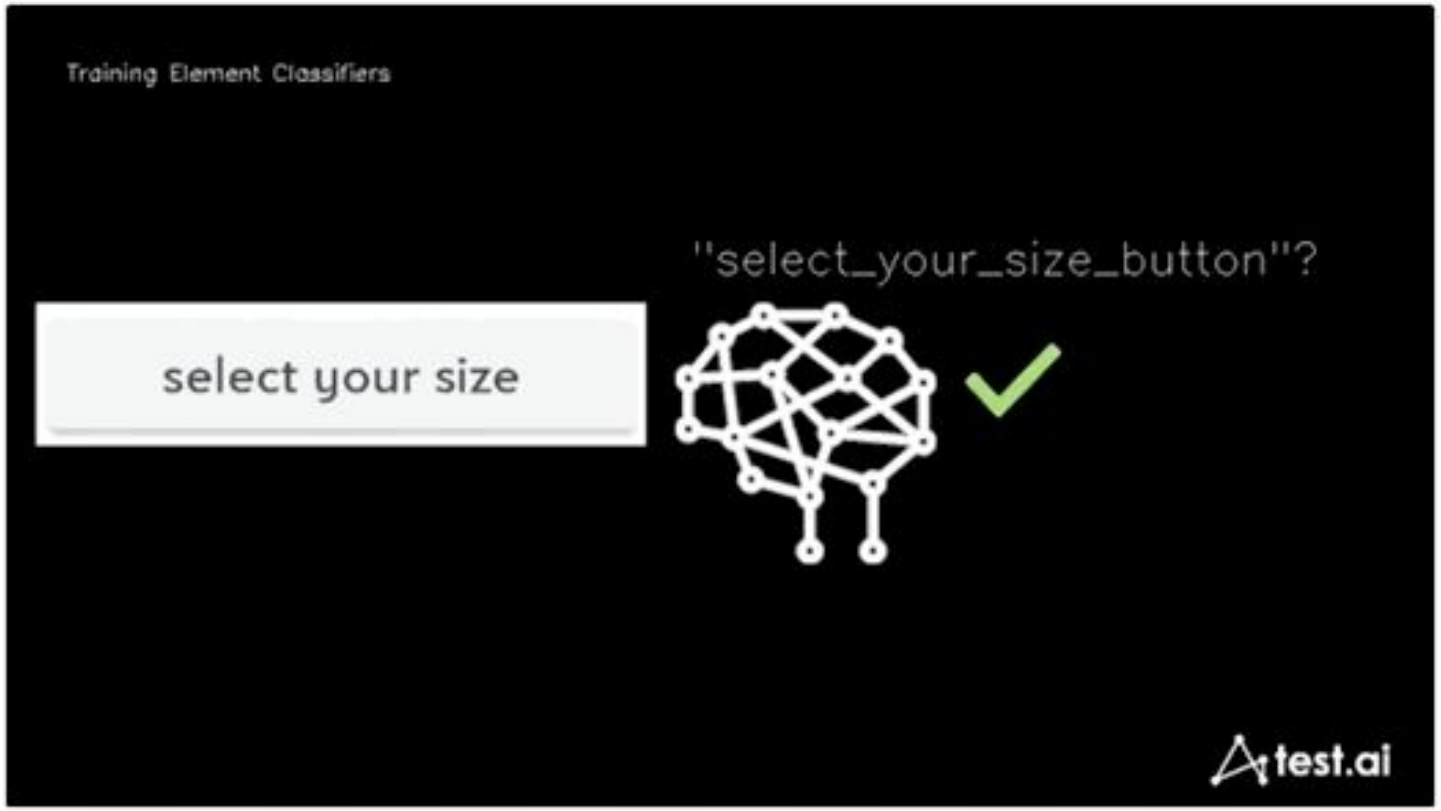
Jason Arbon
CEO @ test.ai
6d

Updated 'Test AI' Training video thanks to feedback!



25 Likes · 1 Comment · 1,300 Views

Like Comment Share

1,300 views of your video

Element Identification

Old / Past

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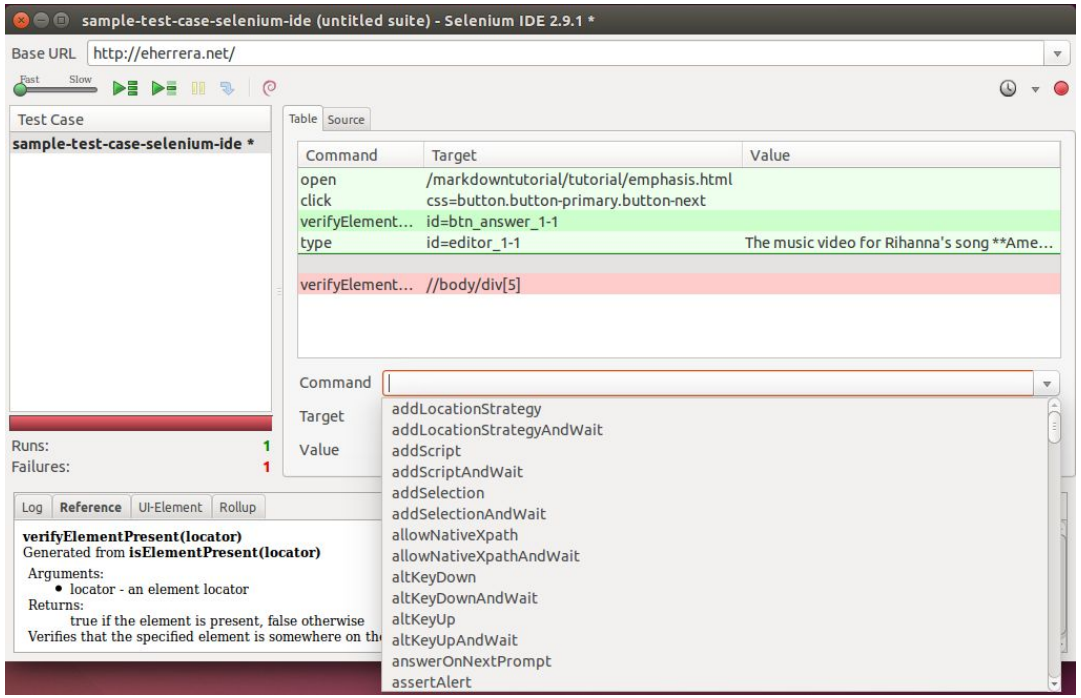
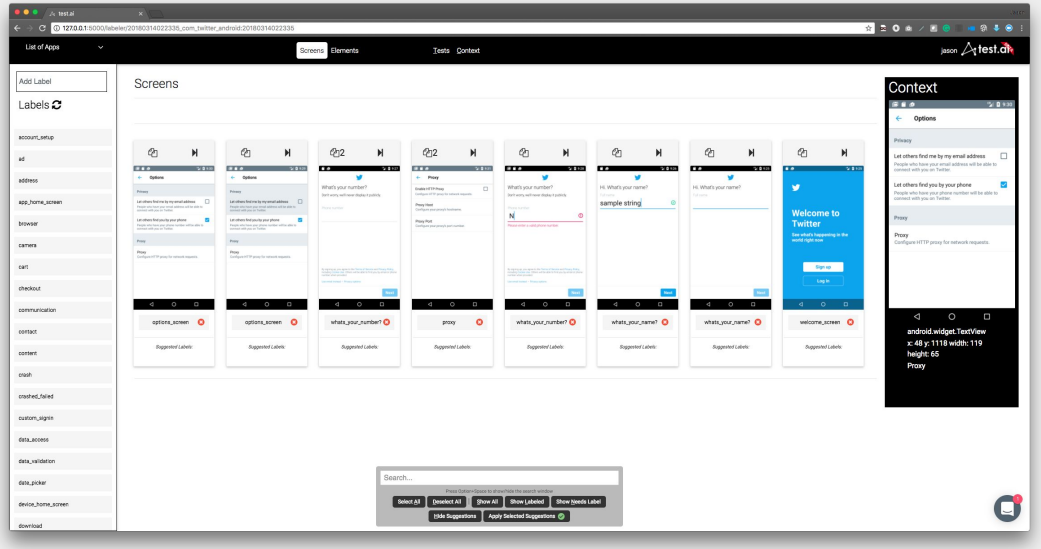
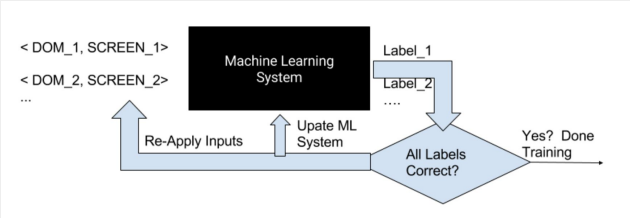



```
public static void main(String[] args) throws InterruptedException {

    System.setProperty("webdriver.chrome.driver","drivers//chromedriver.exe");

    WebDriver driver = new ChromeDriver();

    driver.get("http://omayo.blogspot.com");

    driver.findElement(By.xpath("//*[@id='xyz']")).click();

    Thread.sleep(5000);

    driver.quit();

}
```

Invalid XPath locator, using which no element on the Web Page can be

VS





Selenium IDE

Pain Finding Identifiers

Have to write code. (brittle)

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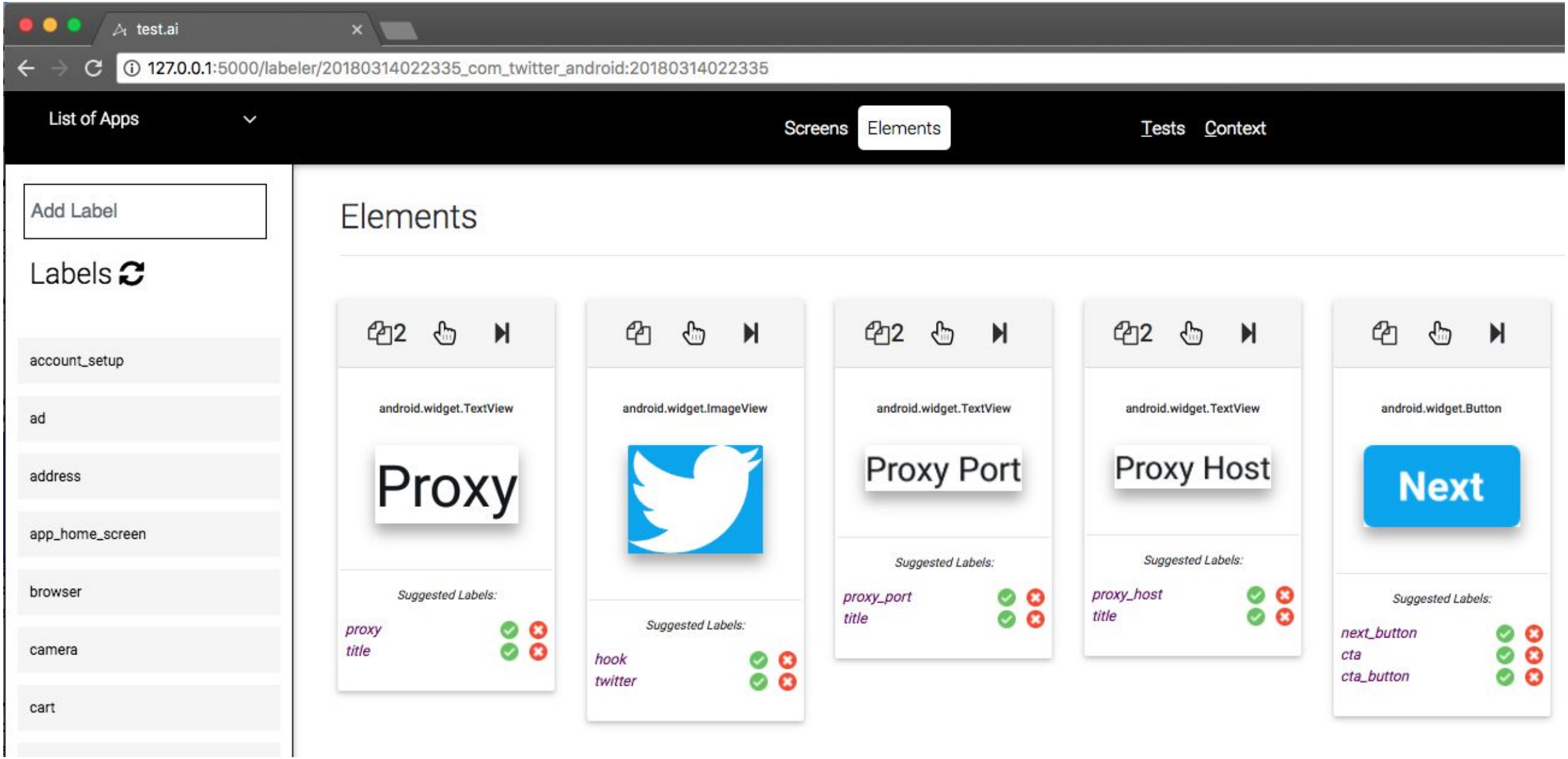
Auto Labeled

Quick Visual Custom Labeling


test.ai
127.0.0.1:5000/labeler/20180314022335_com_twitter_android:20180314022335
List of Apps
Screens
Elements
Tests
Context
Add Label
Labels
account_setup
ad
address
app_home_screen
browser
camera
cart
Elements
2
android.widget.TextView
Proxy
Suggested Labels:
proxy
title
android.widget.ImageView
Suggested Labels:
hook
twitter
2
android.widget.TextView
Proxy Port
Suggested Labels:
proxy_port
title
2
android.widget.TextView
Proxy Host
Suggested Labels:
proxy_host
title
android.widget.Button
Next
Suggested Labels:
next_button
cta
cta_button

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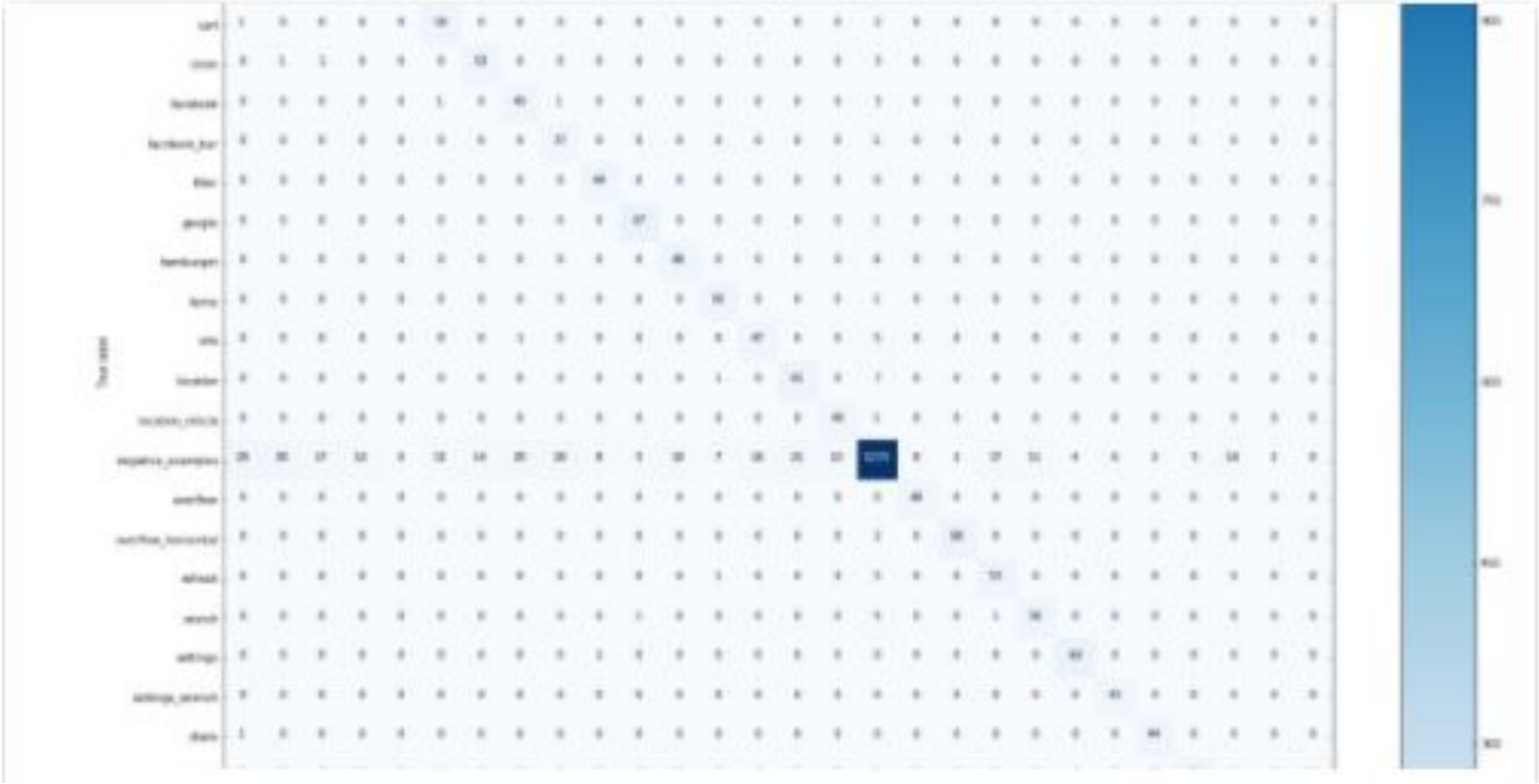
IDENTIFYING APP STATE



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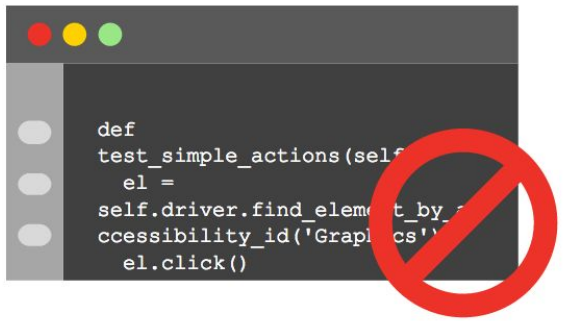
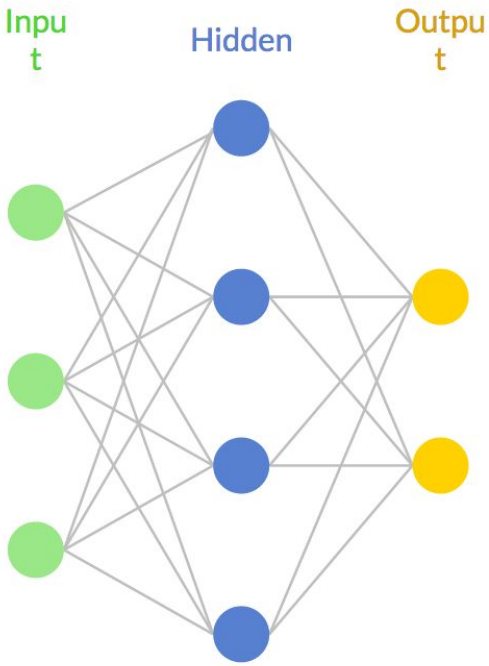
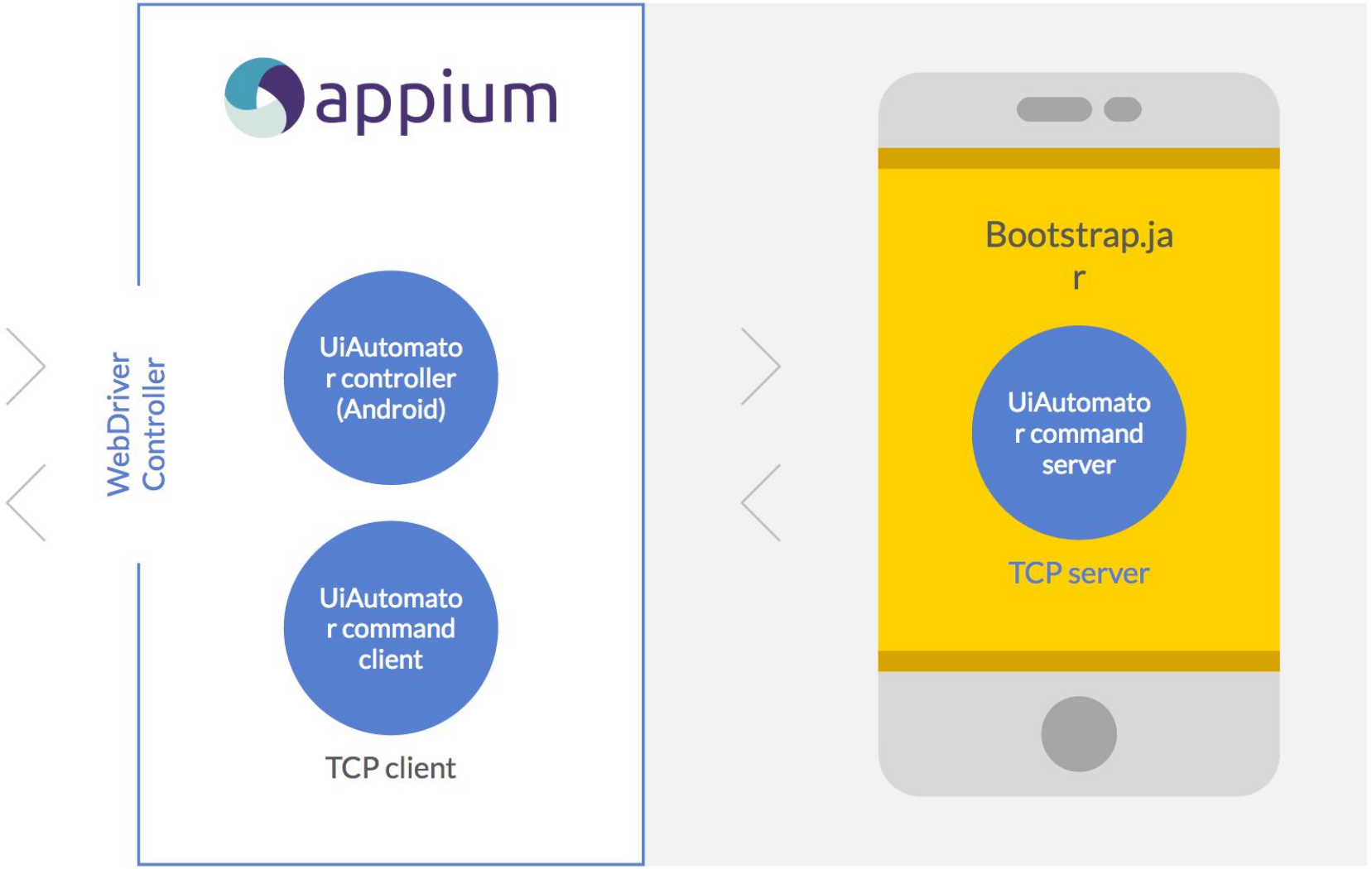
AI Auto-trains to recognize all elements and pages in your app

AI REPLACES HARD-CRAFTED TEST CASES







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Old / Past

Step Sequencing

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```
import java.util.regex.Pattern;
import java.util.concurrent.TimeUnit;
import org.junit.*;
import static org.junit.Assert.*;
import static org.hamcrest.CoreMatchers.*;
import org.openqa.selenium.*;
import org.openqa.selenium.firefox.FirefoxDriver;
import org.openqa.selenium.support.ui.Select;

public class testClass {
  private WebDriver driver;
  @Before
  public void setUp() throws Exception {
    driver = new FirefoxDriver();
  }

  @Test
  public void testtestClass() throws Exception {
    driver.get("http://www.wikipedia.org/");
    Assert.assertEquals("Wikipedia", driver.getTitle());
    Assert.assertEquals("English", driver.findElement(By.cssSelector("strong")).getText());
    driver.findElement(By.cssSelector("strong")).click();
    Assert.assertEquals("Wikipedia, the free encyclopedia", driver.getTitle());
  }

  @After
  public void tearDown() throws Exception {
    driver.quit();
    }
  }
```

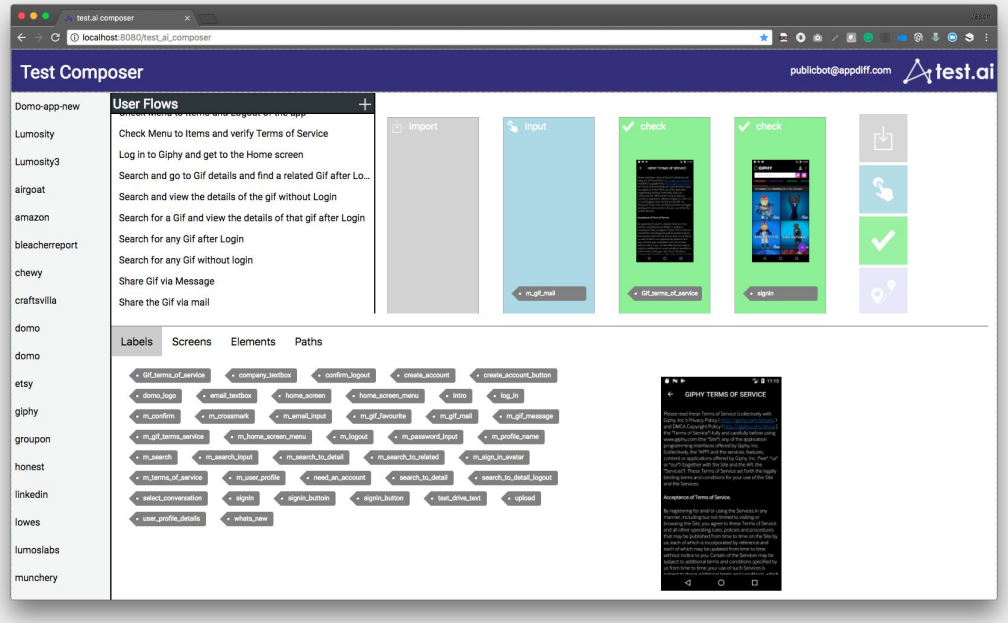
At the top of your Selenium firefox Driver class add the following namespaces

Next under the main section of your SeleniumDriver class create an instance of the FirefoxDriver

Verify and check the correct page is loaded using assertion with the driver's getTitle . getText etc methods.

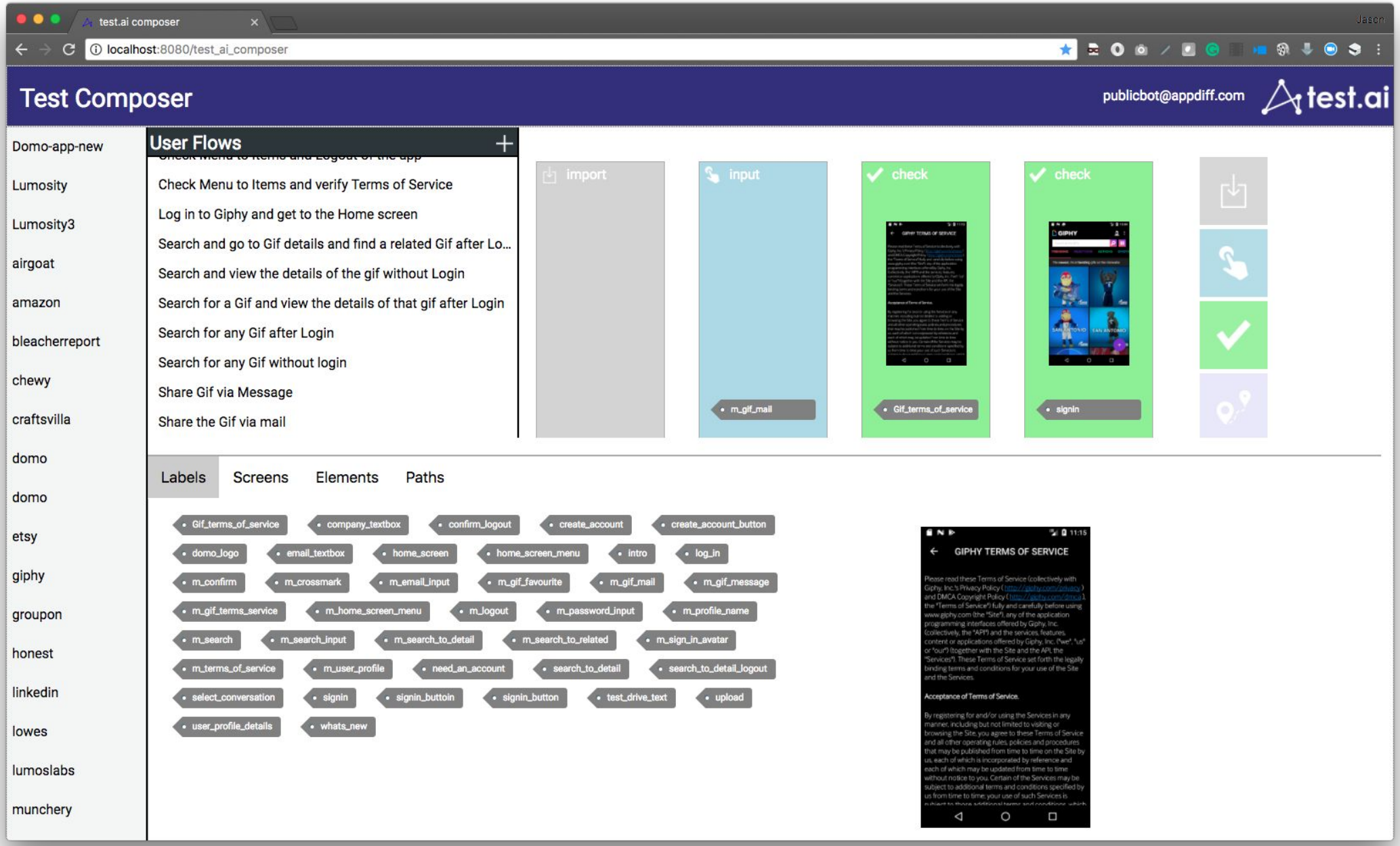
Help to kill all the WebDriver instances

VS



Selenium IDE
Have to code exact steps.
Brittle when app changes.

Test.ai
Familiar Cucumber/Gherkin
Only list labels of interesting steps and verifications.
Also, GUI Editor


test.ai composer
Jason
localhost:8080/test_ai_composer
Test Composer
publicbot@appdiff.com
test.ai
Domo-app-new
Lumosity
Lumosity3
airgoat
amazon
bleacherreport
chewy
craftsvilla
domo
domo
etsy
giphy
groupon
honest
linkedin
lowes
lumoslabs
munchery
User Flows
Check Menu to Items and verify Terms of Service
Log in to Giphy and get to the Home screen
Search and go to Gif details and find a related Gif after Lo...
Search and view the details of the gif without Login
Search for a Gif and view the details of that gif after Login
Search for any Gif after Login
Search for any Gif without login
Share Gif via Message
Share the Gif via mail
import
input
m_gif_mail
check
Gif_terms_of_service
check
signin
Labels
Screens
Elements
Paths
Gif_terms_of_service
company_textbox
confirm_logout
create_account
create_account_button
domo_logo
email_textbox
home_screen
home_screen_menu
intro
log_in
m_confirm
m_crossmark
m_email_input
m_gif_favourite
m_gif_mail
m_gif_message
m_gif_terms_service
m_home_screen_menu
m_logout
m_password_input
m_profile_name
m_search
m_search_input
m_search_to_detail
m_search_to_related
m_sign_in_avatar
m_terms_of_service
m_user_profile
need_an_account
search_to_detail
search_to_detail_logout
select_conversation
signin
signin_buttoin
signin_button
test_drive_text
upload
user_profile_details
whats_new
GIPHY TERMS OF SERVICE
Please read these Terms of Service (collectively with Giphy, Inc.'s Privacy Policy (
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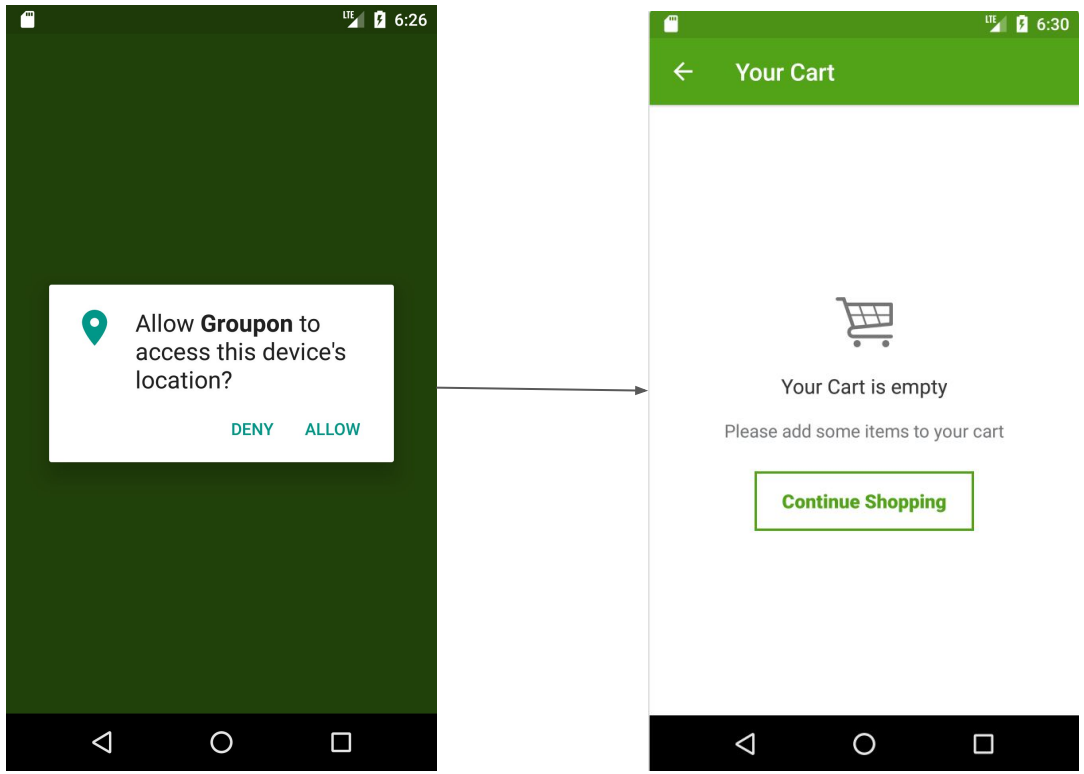
Acceptance of Terms of Service.
By registering for and/or using the Services in any manner, including but not limited to visiting or browsing the Site, you agree to these Terms of Service and all other operating rules, policies and procedures that may be published from time to time on the Site by us, each of which is incorporated by reference and each of which may be updated from time to time without notice to you. Certain of the Services may be subject to additional terms and conditions specified by us from time to time; your use of such Services is

test.ai

Test Composer
test.ai
User Flows
Labels
Screens
Elements
Paths

Where's the AI? *Reinforcement learning*



Robust testing

Instead of prescriptive tests, capture user intent

"Go to the shopping cart"

AIT - Open - Manual Too

```
# Demo AIT Test Definition
Test Name: Remove Beanie Baby from item from cart
  Description: Make sure we can remove an item from the shopping cart.
  Tags: cart, remove
  Step: Search for Beanie Baby
    Context: SCREENNAME “Search”
    Input: ACTION SEARCH “Beanie Babies”
  Step: Add Item
  #Step: Add Item Any item will do.
    Context: SCREENNAME “Product” and HASWORD “Beanie Baby”
    Input: ACTION ADDTOCART
  Step: Remove Item
    Context: Cart and HASWORD “Beanie Baby”
    Input: Remove Item
  Step: Verify Item Removed
    Context: SCREENNAME Cart and NOTHASWORD “Beanie Baby”
```

test.ai

Old / Past

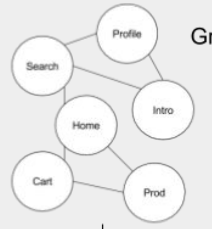
Test Execution

test.ai

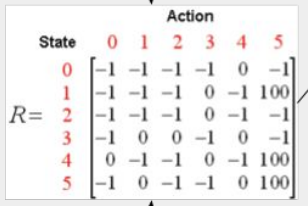
```
adding and manipulating a dream
  ✓ step should result in an alert when there is no dream (6663ms)
  ✓ should add a new dream (30247ms)
  ✓ should change dream name (15472ms)
  ✓ should add a reason to a dream (16847ms)
  ✓ should add steps to a dream (27841ms)
  ✓ should remove a dream (9793ms)

log out user
  ✓ should logout mr. freeman (4693ms)
```

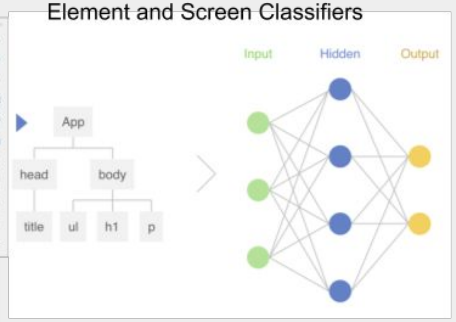
VS



Graph of App



Element and Screen Classifiers



Step Actions + Verifications

AIT Test Case

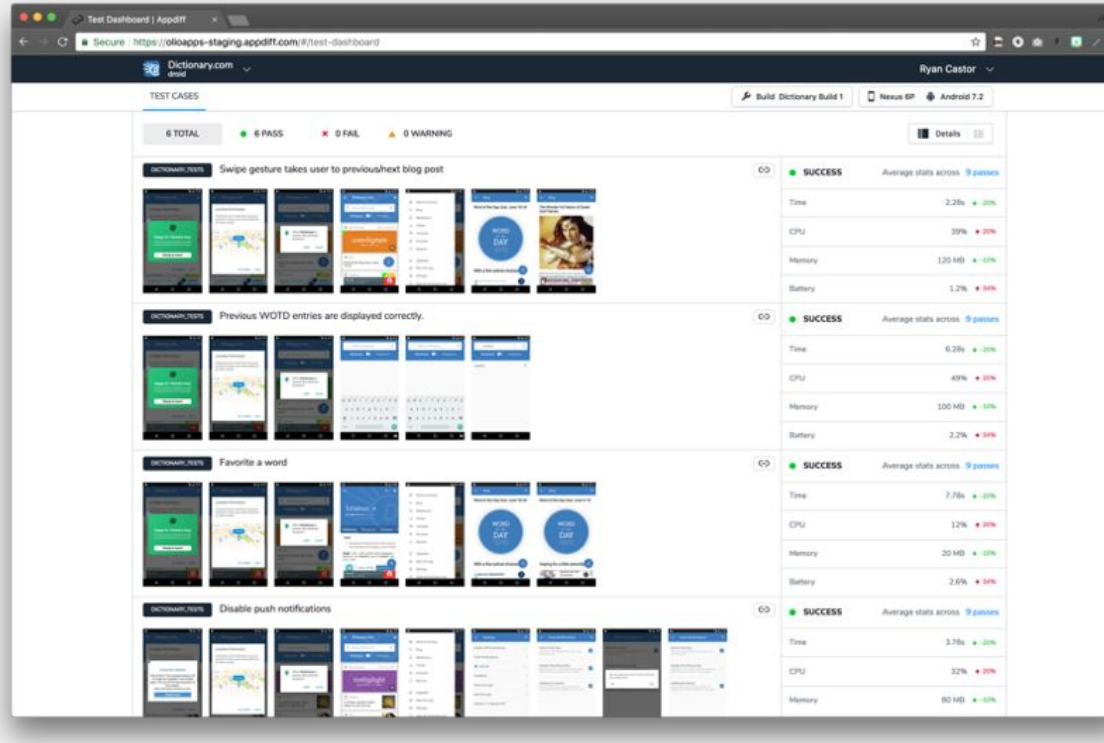
Old / Past

Test Reporting

test.ai

Chart	See children	Build Number ⇒ Package-Class-Testmethod names ⇓	16	15	14	13	12	11	10	9	8	7	6	5
	⊖	org.common.samplea	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	N/A
	⊖	SampleATest	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	N/A
		testA	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	N/A
		testB	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	N/A
		testC	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	N/A
		testD	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	N/A
	⊕	org.common.sampleb	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	FAILED	N/A
	⊖	org.common.samplec	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	N/A
	⊖	SampleDTest	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	N/A
		testA	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	N/A
		testB	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	N/A
		testC	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	SKIPPED	N/A
		testD	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	PASSED	N/A

VS



Selenium IDE

Many Tests Flaky/Break as app Changes

Simple pass/fail

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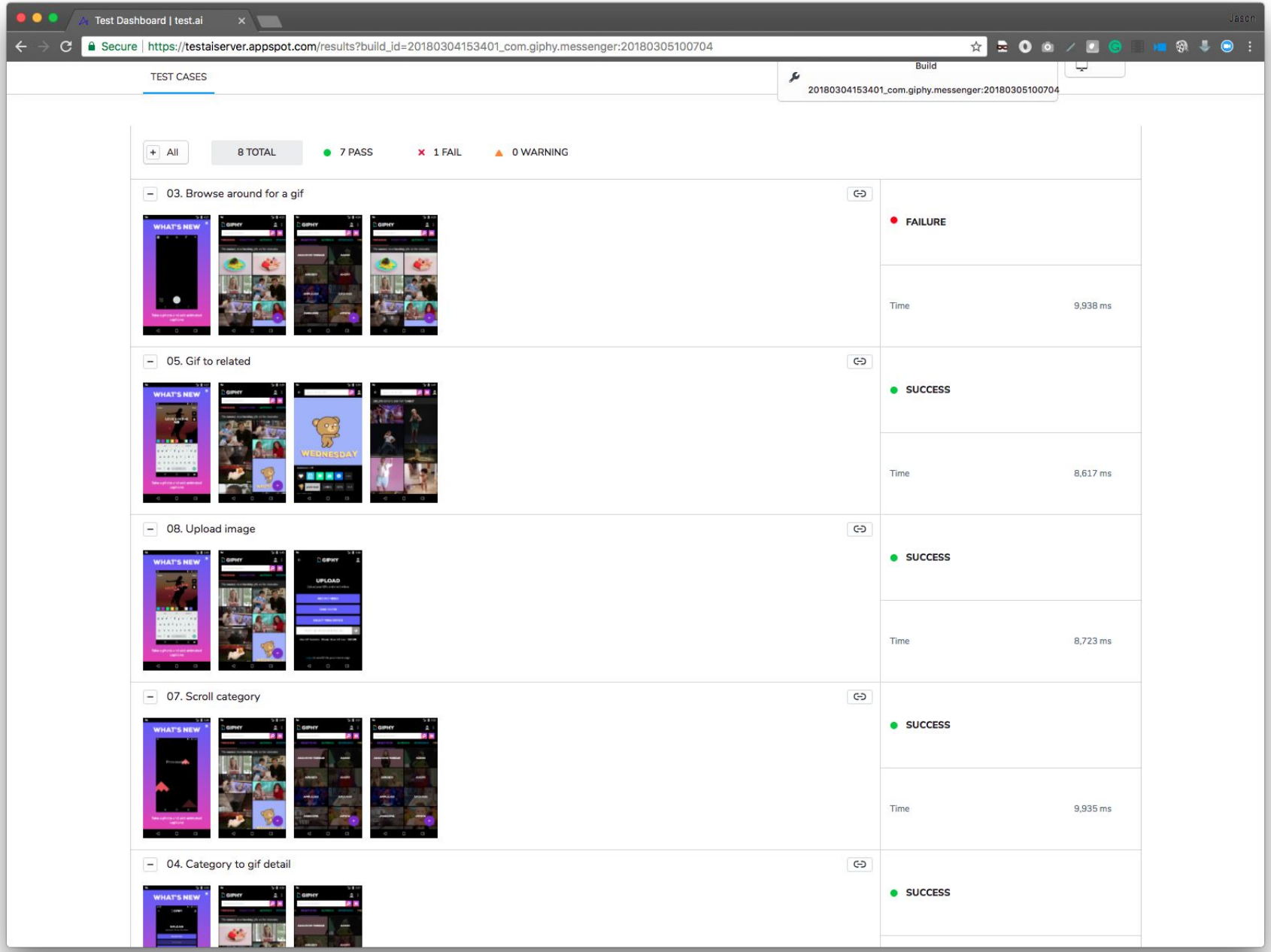
Q-Learning Test Step Generation

Element Classifiers at runtime

See Test Steps.

Presentable.


Test Dashboard | test.ai
Secure | https://testaiserver.appspot.com/results?build_id=20180304153401_com.giphy.messenger:20180305100704
TEST CASES
Build
20180304153401_com.giphy.messenger:20180305100704
All
8 TOTAL
7 PASS
1 FAIL
0 WARNING
03. Browse around for a gif
FAILURE
Time 9,938 ms
05. Gif to related
SUCCESS
Time 8,617 ms
08. Upload image
SUCCESS
Time 8,723 ms
07. Scroll category
SUCCESS
Time 9,935 ms
04. Category to gif detail
SUCCESS

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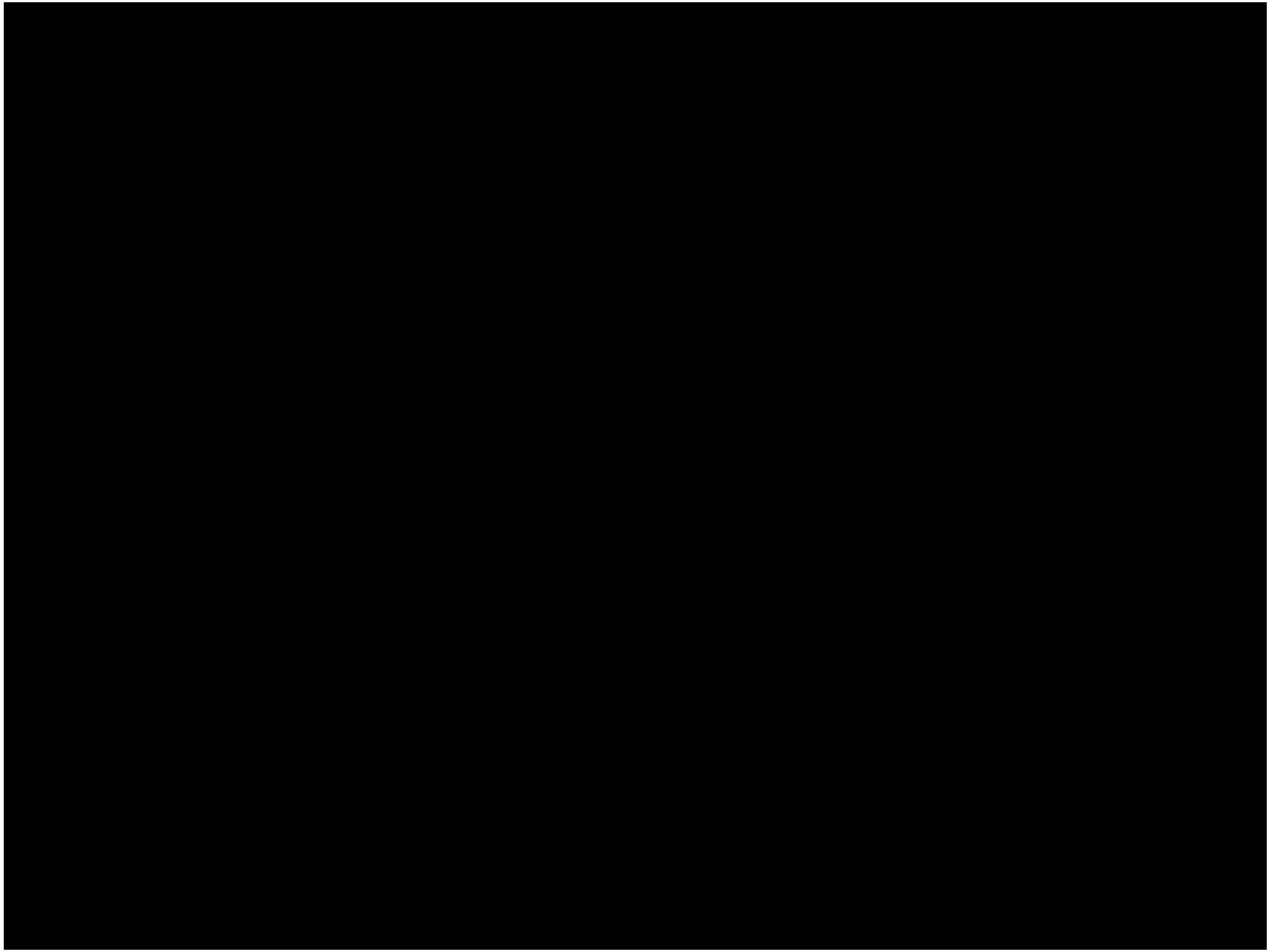
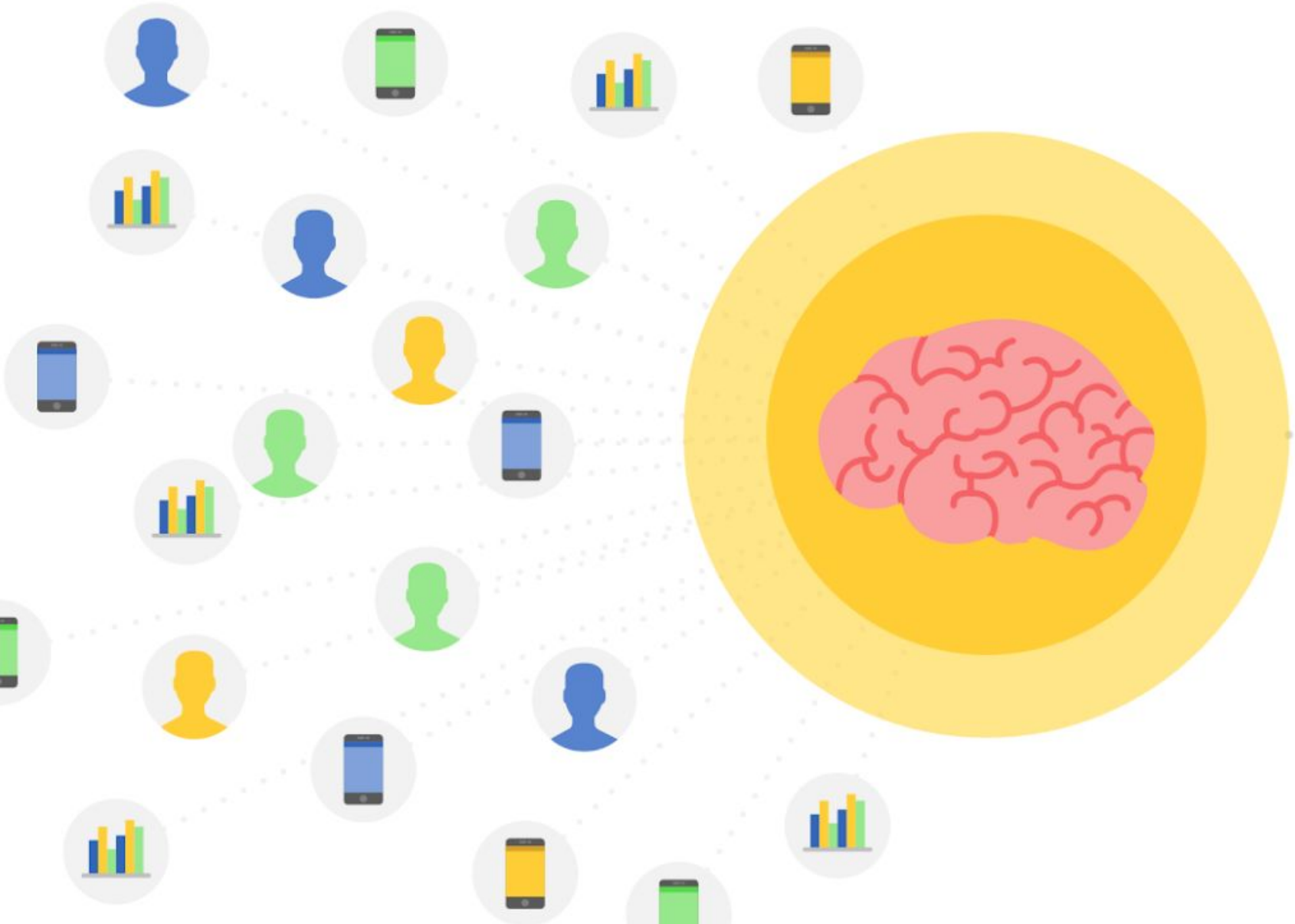
Test Run Cross Platform, Cross App!



HARNESSING COLLECTIVE INTELLIGENCE FOR TESTING



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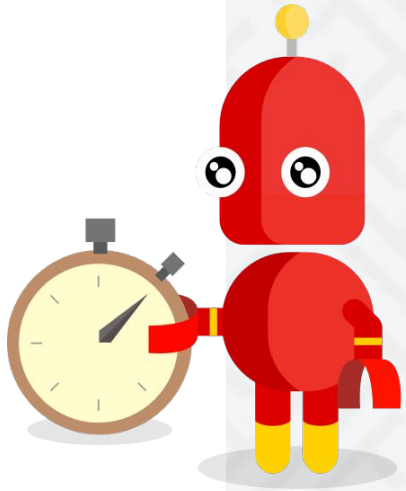
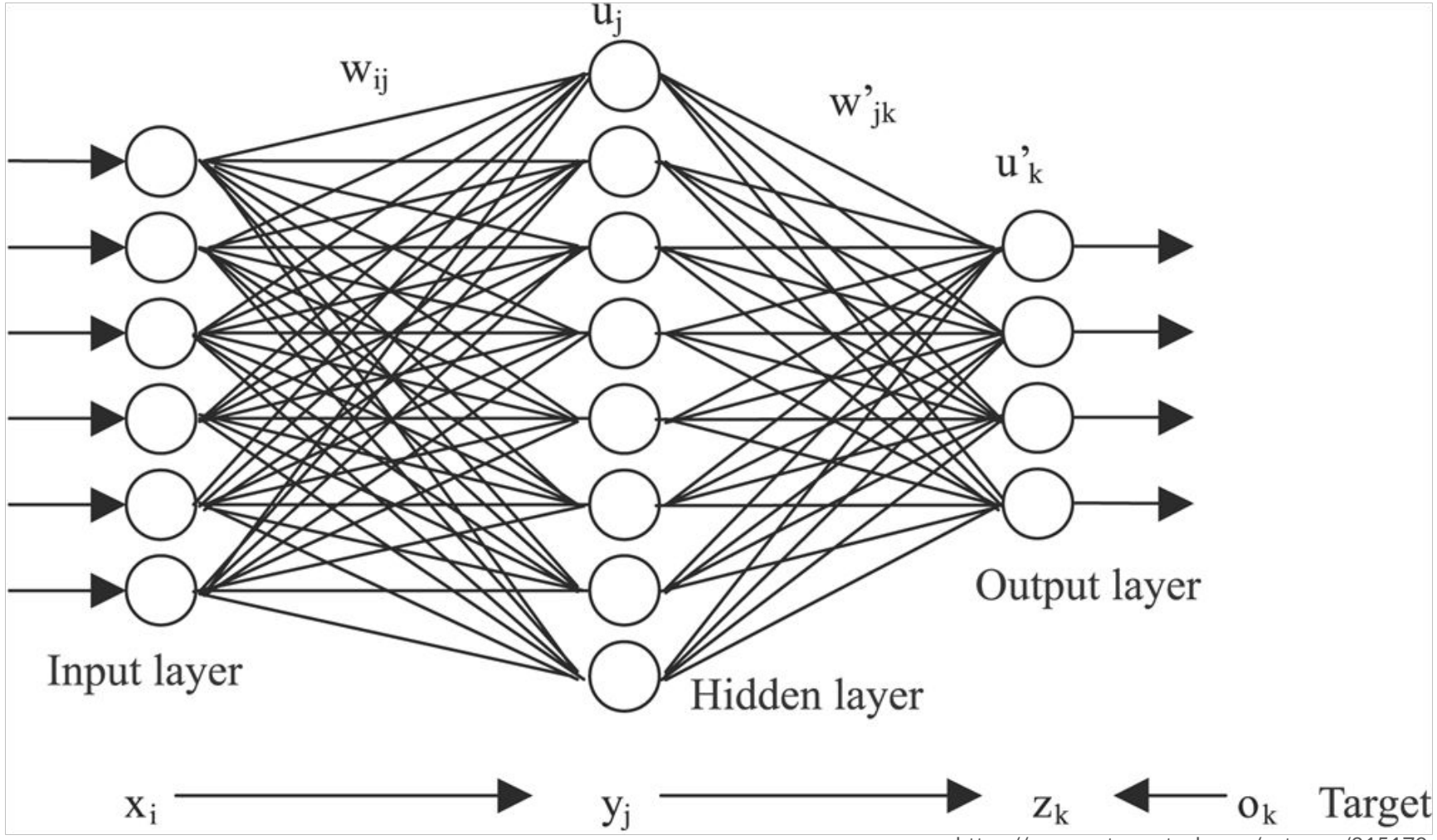
APPDIFF

How to test AI?



Testing AI: Test Boundary + Input

Test Data outside the range of Training Data. Errors are at the margins.



https://www.extremetech.com/extreme/215170-artificial-neural-networks-are-changing-the-world-what-are-they

Testing AI: Test Boundary Input

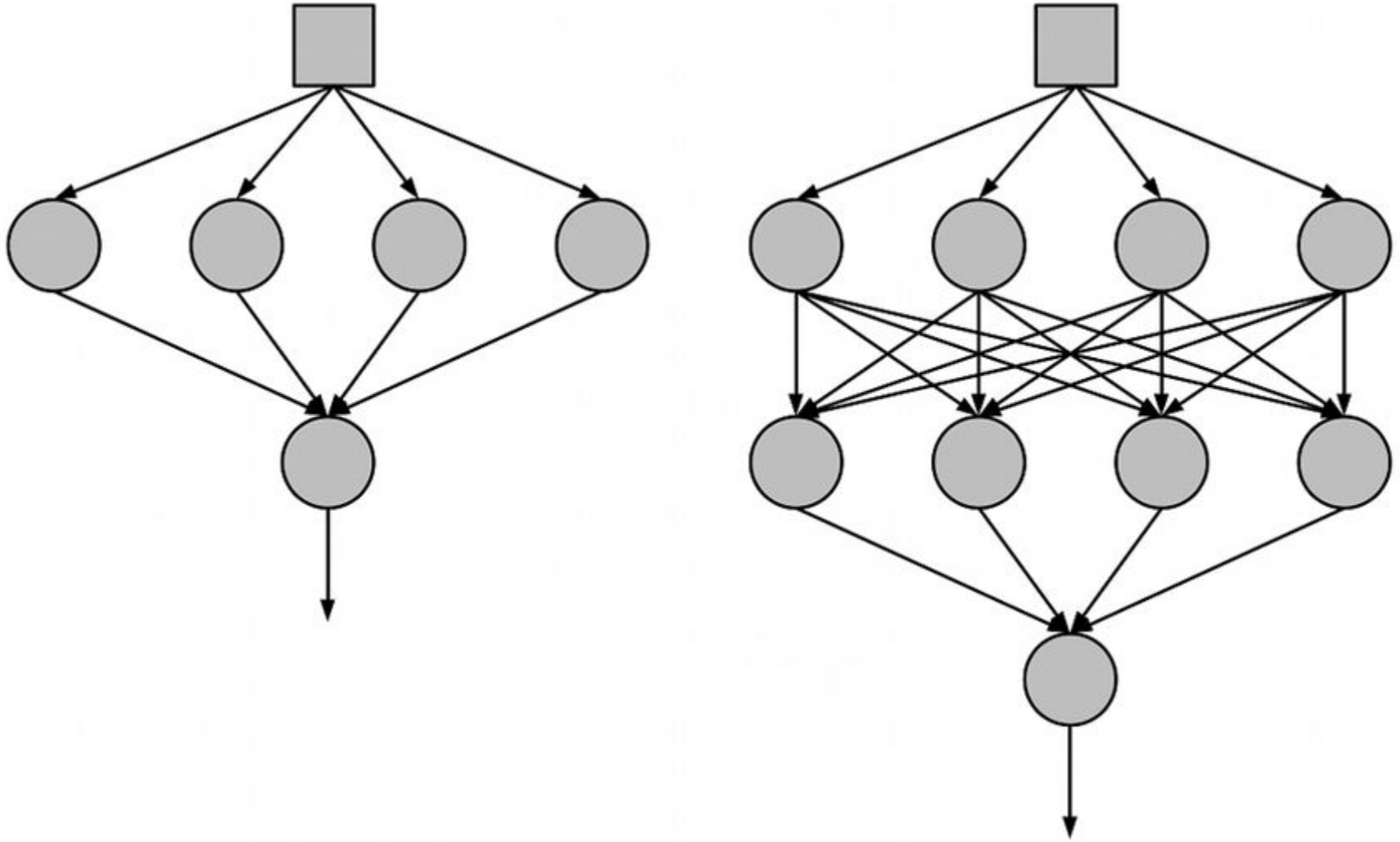
Test Data outside the range of Training Data. Errors are at the margins.

Testing AI: Feature Correctness

AI “input” correctness

- Features computed correctly
- E.g. “#words on page”
- Representative Sample?
- Bad/Partial data?
- Sample Temporal/Domain relevance?

Testing AI: Each new build--consider it a new implementation



Credit: https://www.researchgate.net/figure/224915935_fig2_Figure-1-Neural-Network-Architectures-Used-in-the-SimulationsTwo-different-neural

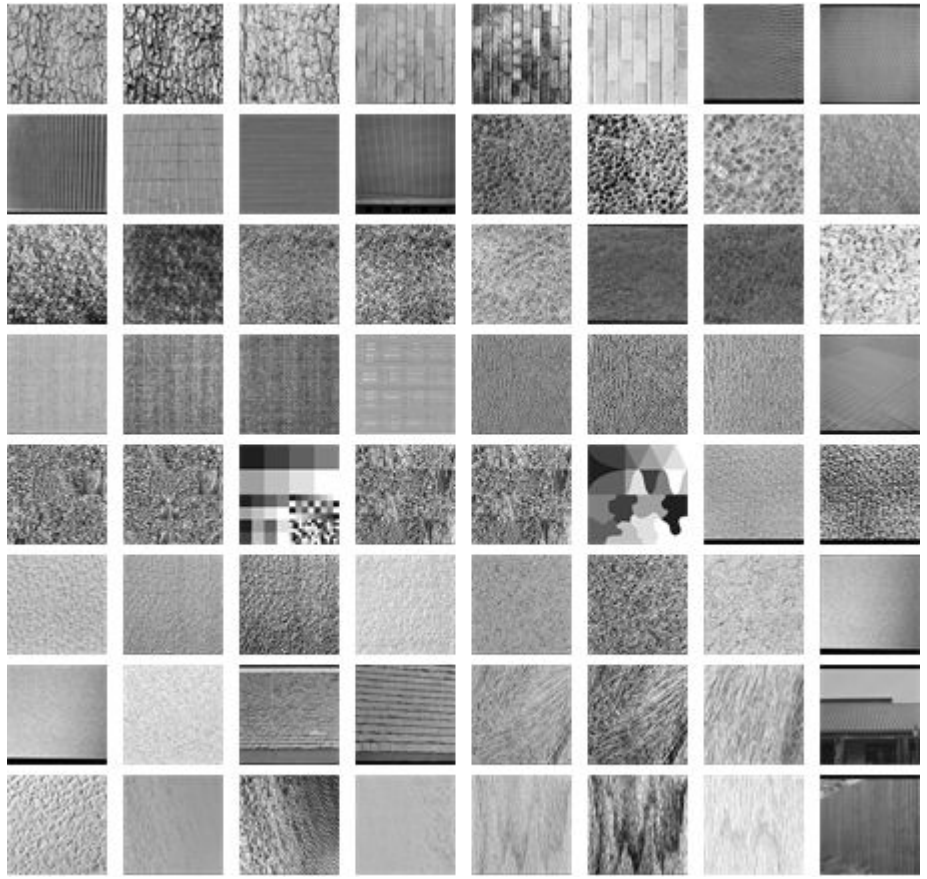
Testing AI: “Drift”

Networks are randomly initialized

New network might be just as accurate as last network
ON AVERAGE

Test for the texture change.

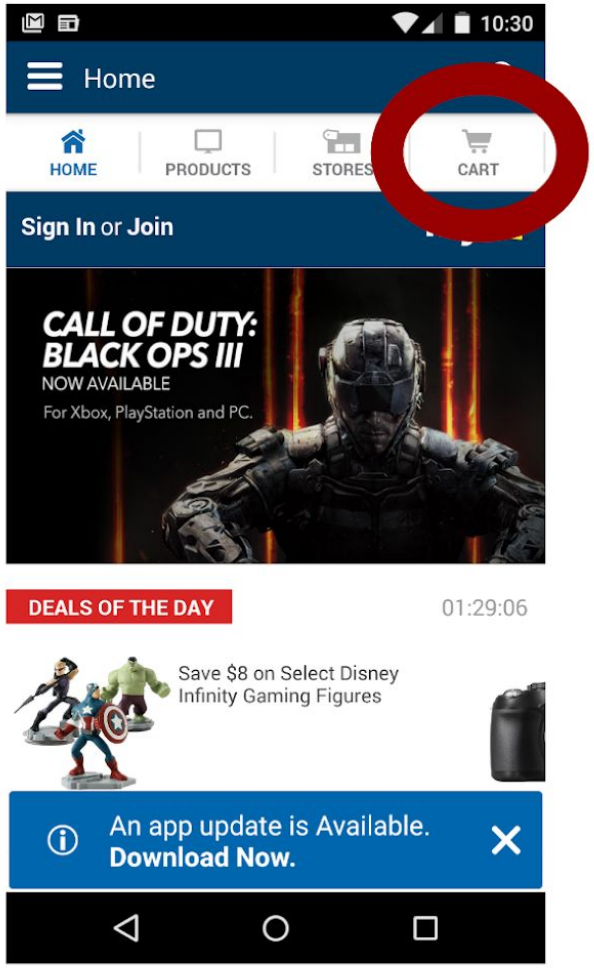
Mapping from network output -> product output functionally correct.



Credit: https://www.wolfram.com

Testing AI: Action / Flow Graphs

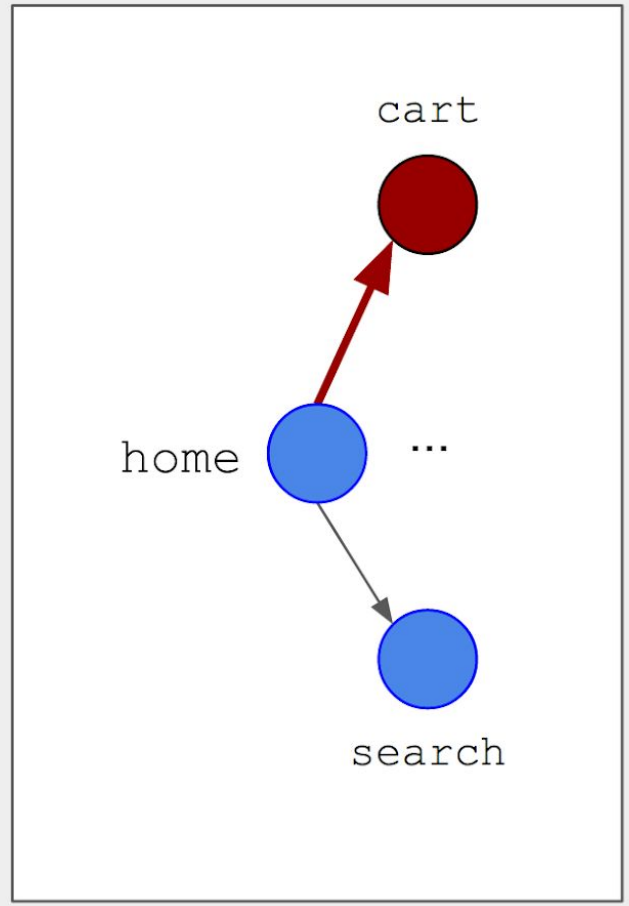
Raw Button



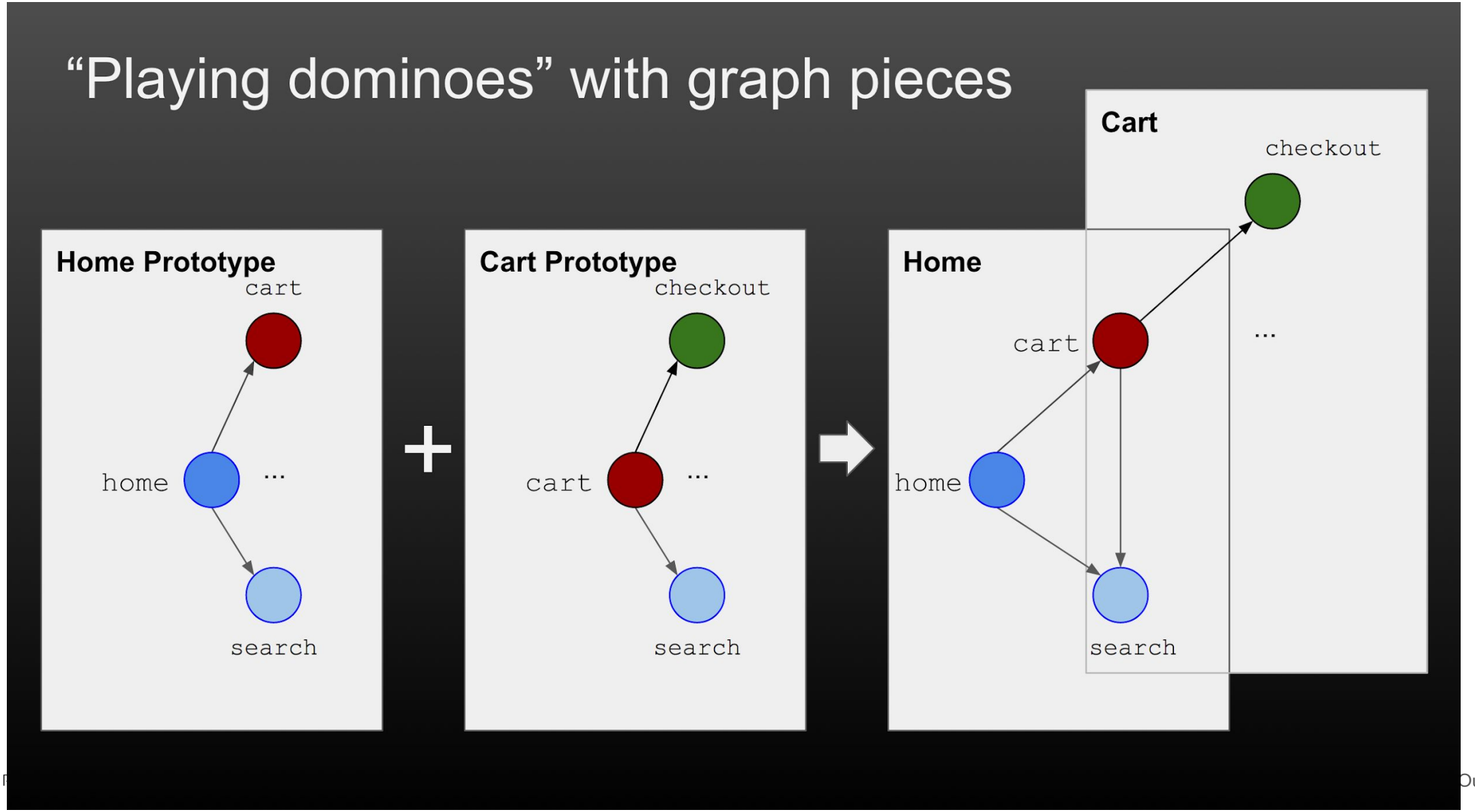
Button Vector Representation

is_search_btn	0
is_hamburger_btn	0
is_cart_btn	1
...	...
is_click	1
is_swipe	0

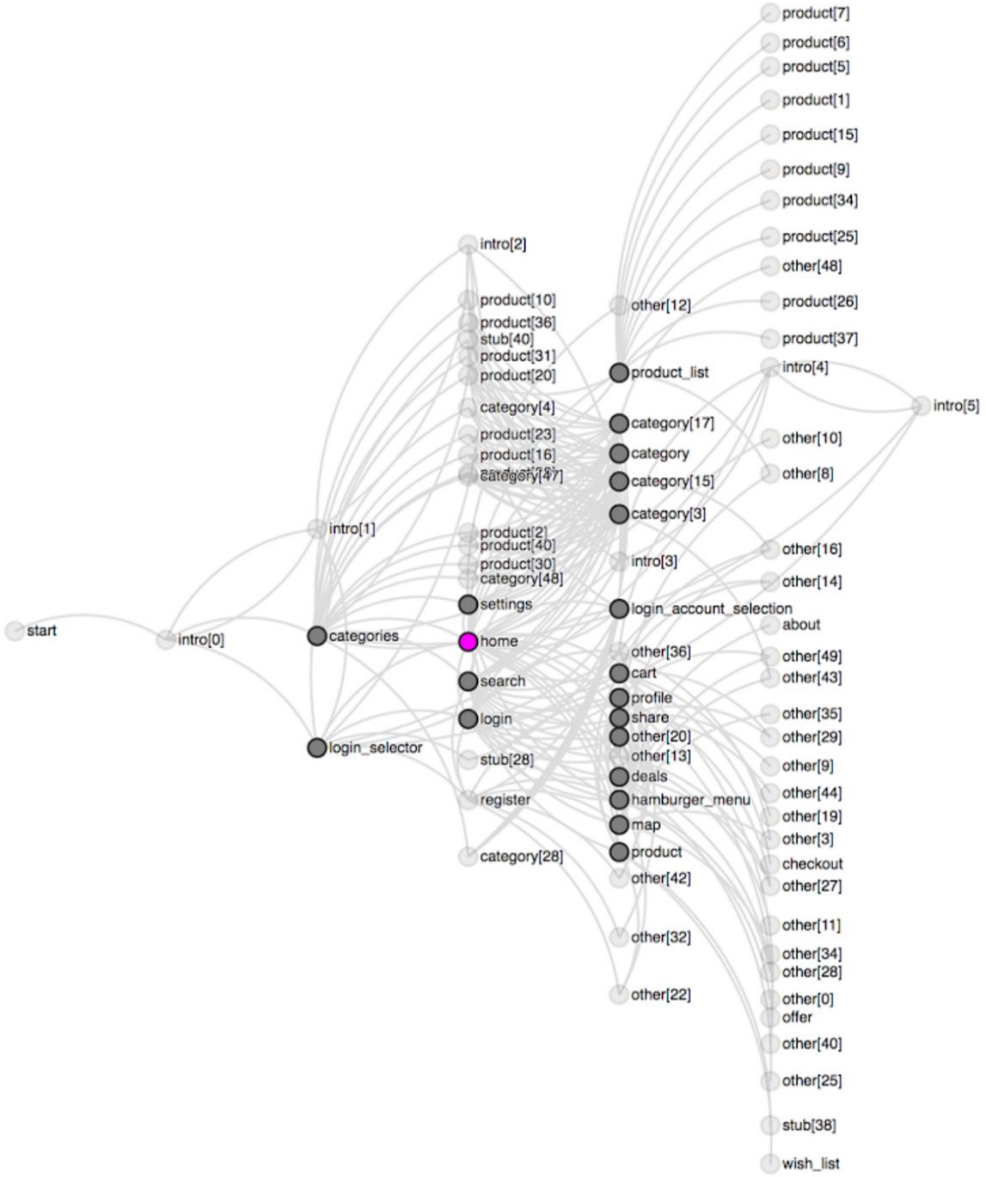
Graph Representation



Testing AI: App Generation and Traversal

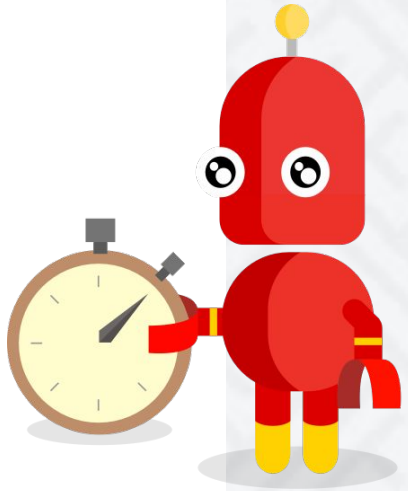


Testing AI: Test Graph Generation and Traversal



APPDIFF

What is Next?



Testing AI: “DARPA HARD”

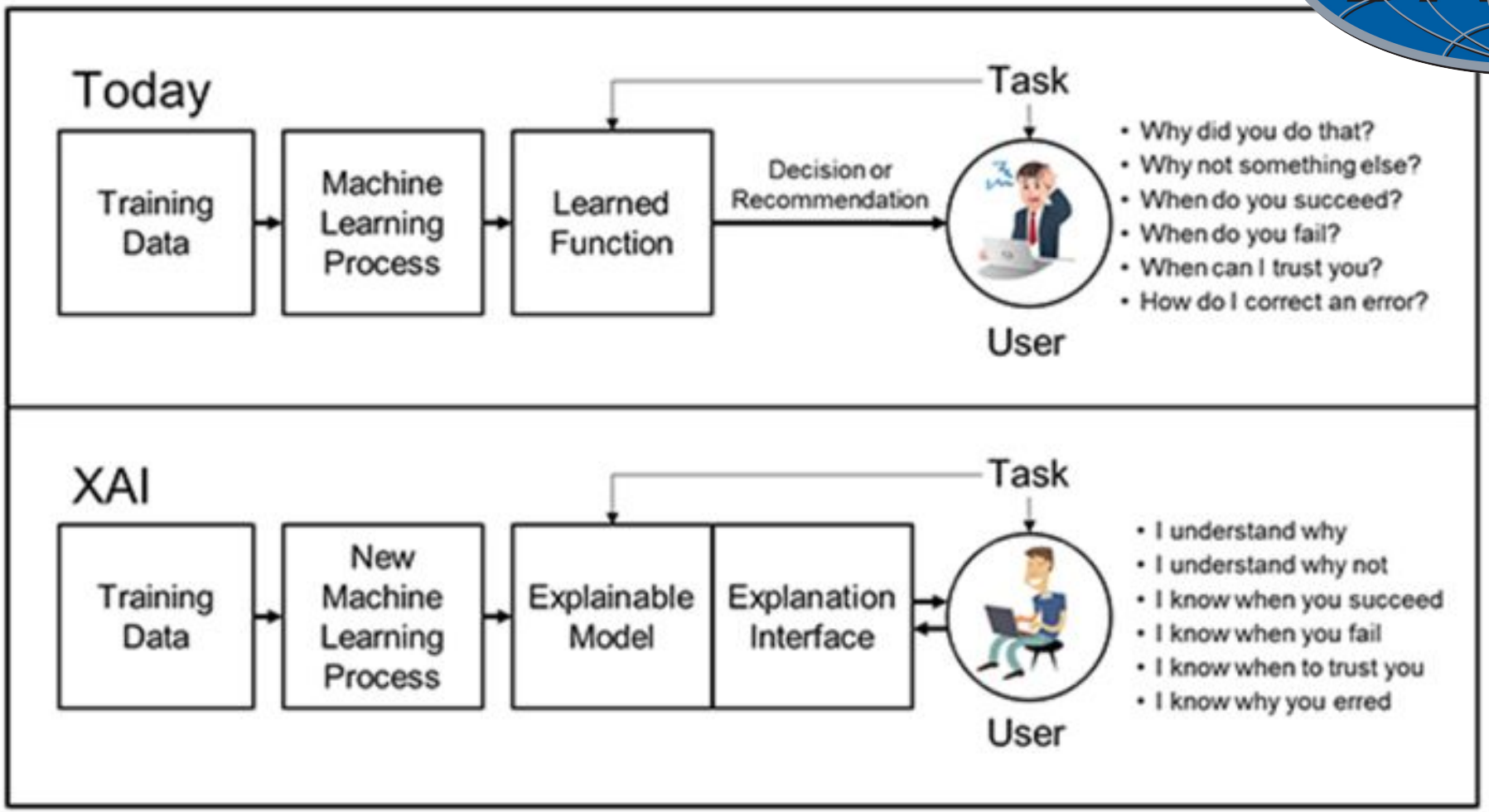
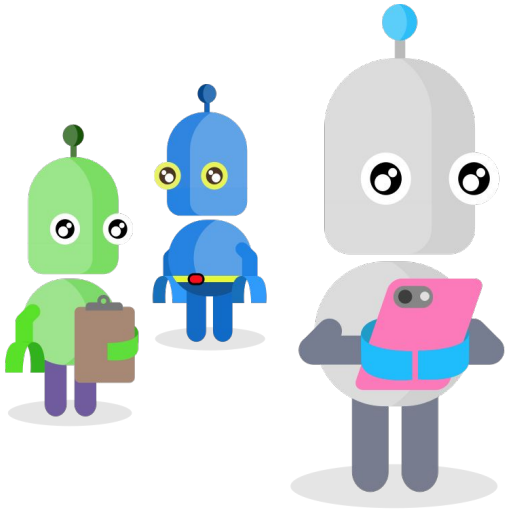


Figure 1: XAI Concept

Humans vs Bots

VS



Humans Train Bots in Course of Work

Humans Remain to Personalize and Re-train bots.

Little testing that AI cannot do “soon”

Abstract Intent Language: AIT

Focus on Intent, not “how”

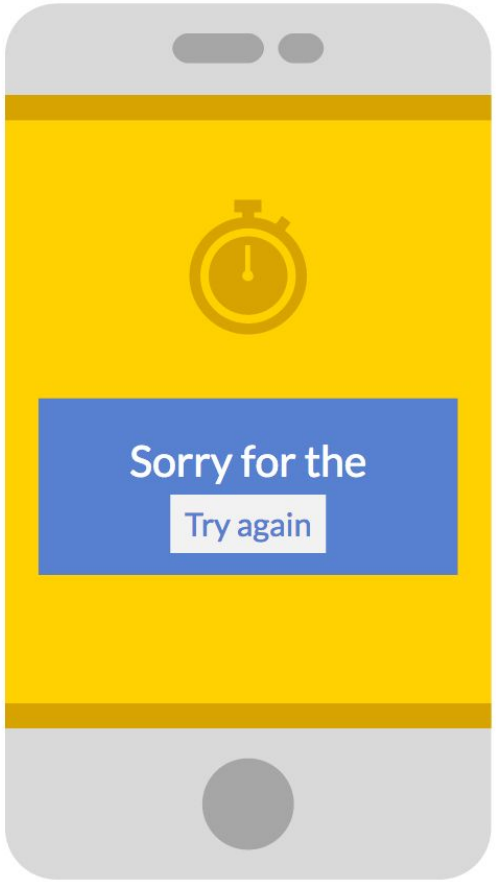
Human Readable

App-Independant

jason@test.ai

@jarbon

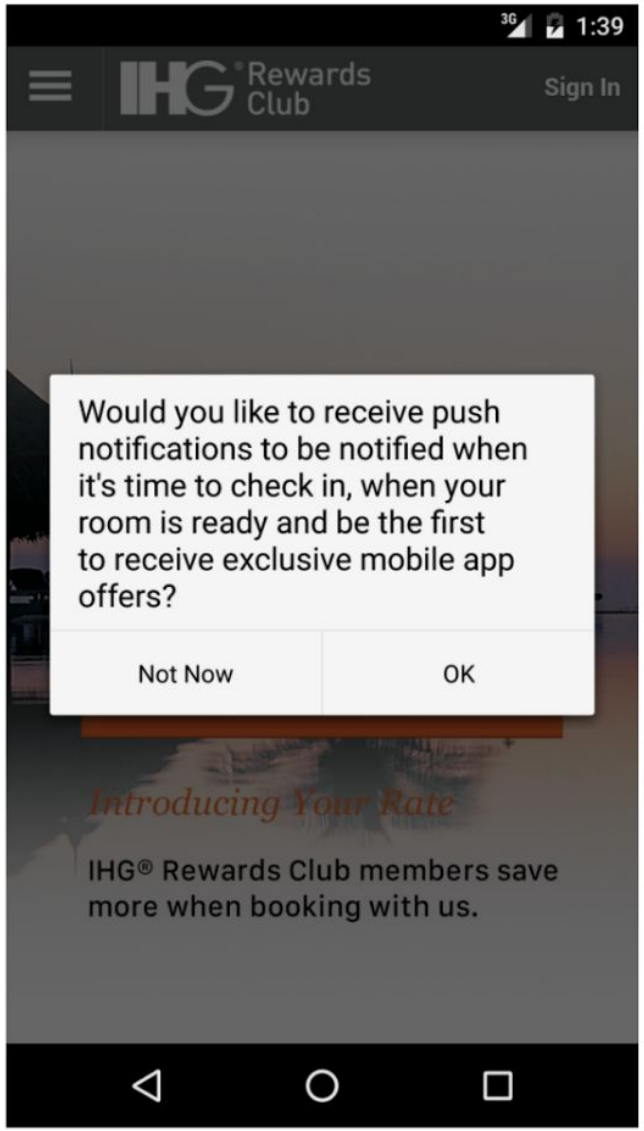
EXAMPLE: HOW TO DETECT A BUG



App structure:	Small
UI elements:	Alert box
Complexity:	Low
Text:	*"Sorry for the delay"*
	"Try again"

Classification:

ML : Subjective or complex labels via Humans



Choose a category:

- Intro Screen/ Welcome Screen
- Login Screen/ Sign Up Screen
- Privacy Policy Screen/ Terms and Conditions Screen
- Home Screen
- Side Menu Screen
- Popup Screen
- Others

Describe for Others Category:

Submit

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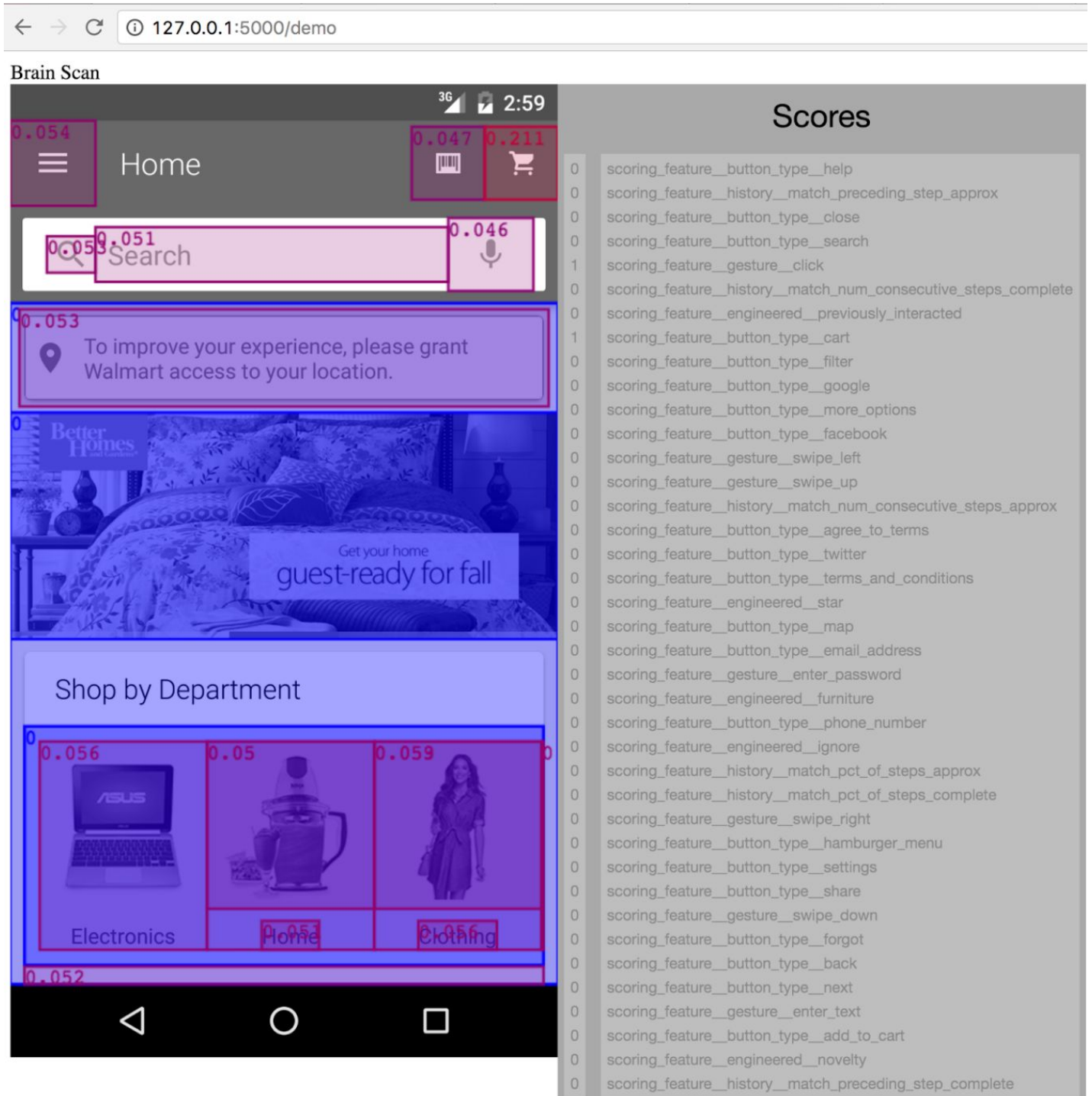
AI for Testing: Input

Reduce input space

150 actions per page

35 steps -> 150^35 = 10^78 paths

#atoms in universe 10^78...



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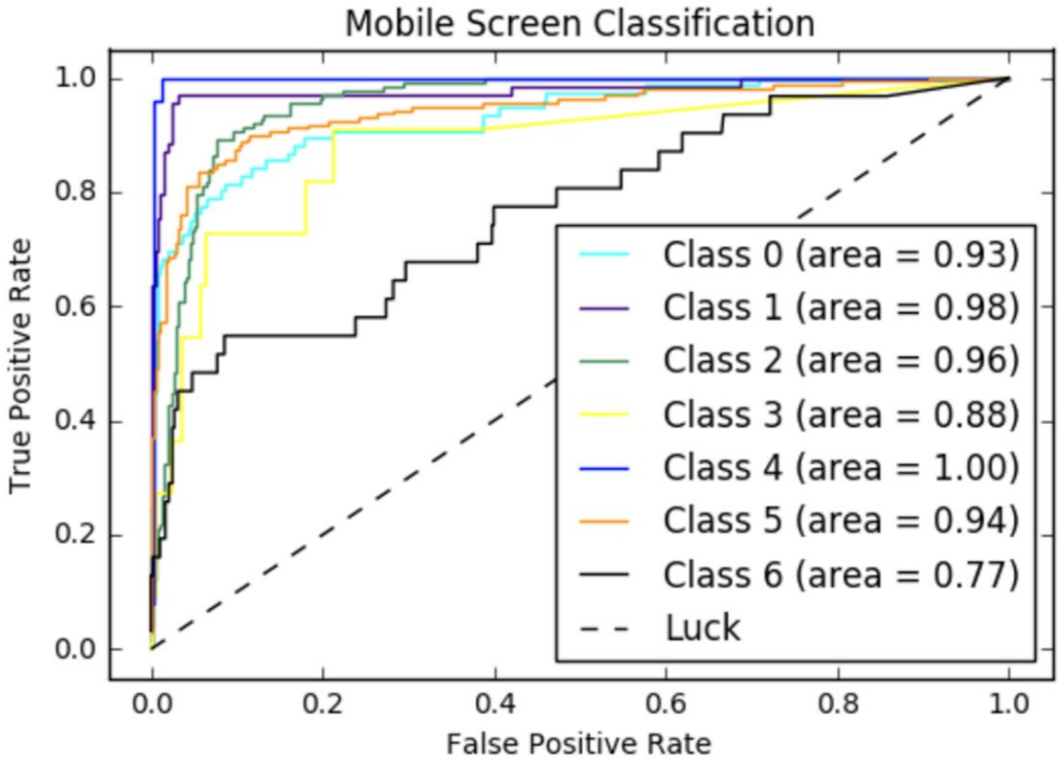
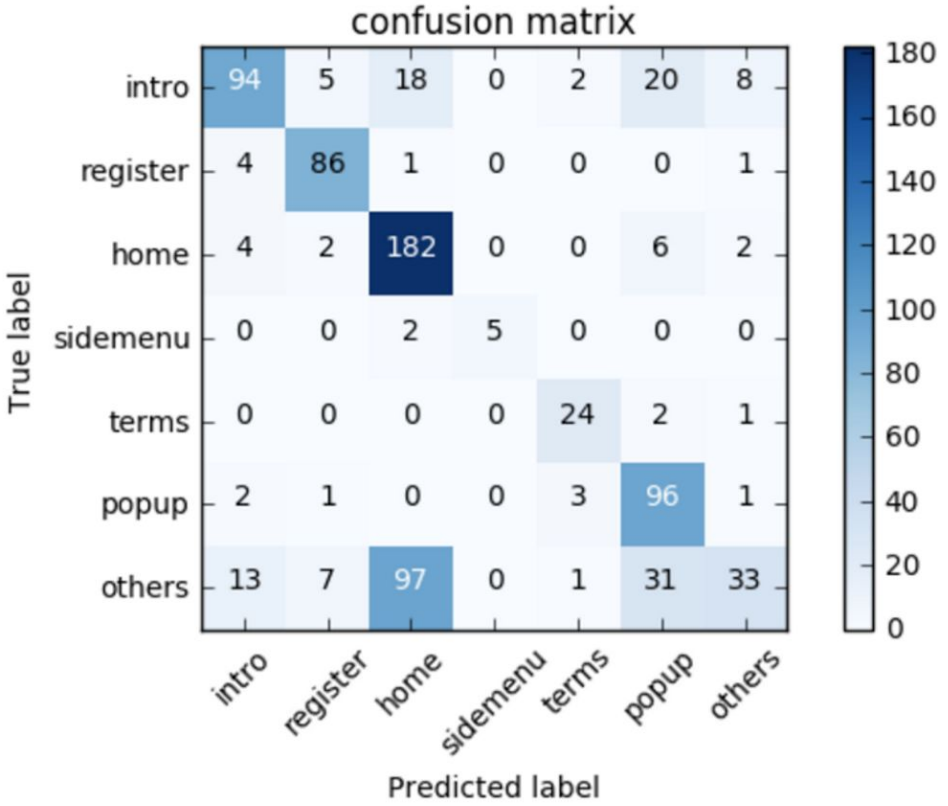
ML: Page Label Training





Accuracy: 0.689655172414

	precision	recall	f1-score	support
0	0.80	0.64	0.71	147
1	0.85	0.93	0.89	92
2	0.61	0.93	0.73	196
3	1.00	0.71	0.83	7
4	0.80	0.89	0.84	27
5	0.62	0.93	0.74	103
6	0.72	0.18	0.29	182
avg / total	0.71	0.69	0.65	754

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