AT8
Agile Practices
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Future-Proofing Testers in the Age of AI, ML, and Bots

Presented by:

Eran Kinsbruner

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350 Corporate Way, Suite 400, Orange Park, FL 32073
888-268-8770 ·· 904-278-0524 - info@techwell.com - http://www.starwest.techwell.com/

Eran Kinsbruner

Eran Kinsbruner is the mobile evangelist at Perfecto and the author of The Digital Quality Handbook, as well as a monthly columnist at InfoWorld.com. He is a software engineering professional with nearly twenty years of experience at companies such as Matrix, Sun Microsystems, General Electric, Texas Instruments and NeuStar. He holds various industry certifications from ISTQB, CMMI, and others. Eran is a recognized mobile testing influencer and thought leader, as well as an experienced speaker in the major software engineering conferences. He is also a patent-holding inventor for a test exclusion automated mechanism for mobile J2ME testing, public speaker, researcher, and blogger. He can be found all over social media, including on Facebook, Twitter (@ek121268), LinkedIn, and his professional mobile testing blog.

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Seek Perfection

Agile + DevOps **EAST**

A TECHWELL EVENT
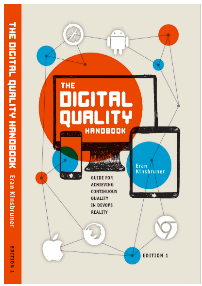
Eran Kinsbruner

@ek121268, http://continuoustesting.blog

erank@perfecto.io

Future-Proofing Testers in the Age of AI, ML, and Bots

About Me

Perfecto

- Lead Technical Evangelist at Perfecto
- Blogger and Speaker
    - http://mobiletestingblog.com
    - https://www.infoworld.com/author/Eran-Kinsbruner/
- 18+ Years in Development & Testing
- Author of *The Digital Quality Handbook*, and *Continuous Testing for DevOps Professionals*

Weekly Podcast - Testiumpod

THE DIGITAL QUALITY HANDBOOK

CONTINUOUS TESTING FOR DEVOPS PROFESSIONALS

A PRACTICAL GUIDE FROM INDUSTRY PROS
BY ERAN KINSBRUNER

Agenda

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- DevOps Transformation & Trends
- Defining AI & ML
- Top AI and ML Algorithms
- AI/ML Tool Landscape for Mobile and Web
- The Role and Skills Required for Testers
- Q & A

PAST vs. The FUTURE

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Defining AI

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Artificial Intelligence: Sometimes called **machine intelligence**, is intelligence demonstrated by machines, in contrast to the **natural intelligence** displayed by humans and other animals. In computer science AI research is defined as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. The term "artificial intelligence" is applied when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving".

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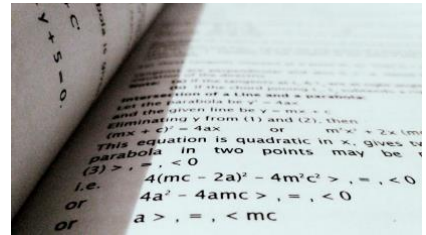
Defining ML

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An algorithm which gives a **statistic answer** to **well-defined question** based on **previous results**

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Basic Terms

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- **Supervised classification**– collection of examples with the current answers
  - Recognize person based on tagged photo album
  - Recommendations system (Netflix) - match a movie based on proviruses choices

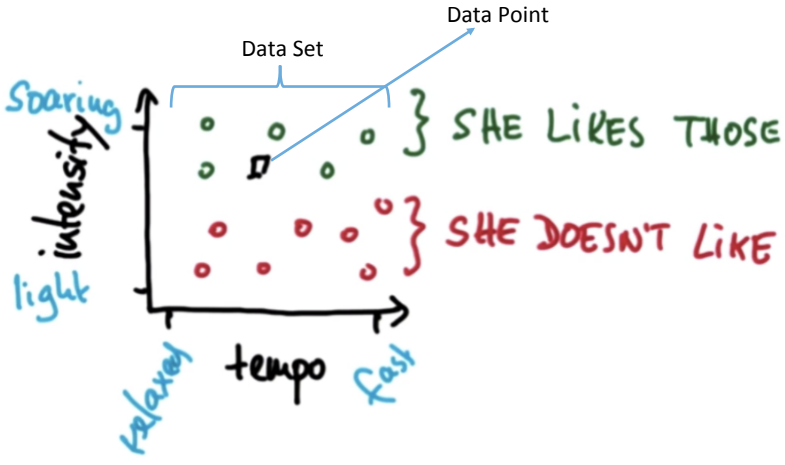- **Training data –** List of organized input-output data (Future and label)

Future and label

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well-defined question – is she going to like a song
previous results = data set

Data Point

Data Set

Soaring

intensity

light

relaxed   tempo   fast

SHE LIKES THOSE

SHE DOESN'T LIKE

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Top Used ML/AI Techniques: Gradient Descent

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- Gradient Descent - Is a first-order iterative optimization algorithm for finding the minimum of a function. To find a local minimum of a function using gradient descent, one takes steps proportional to the *negative* of the gradient (or approximate gradient) of the function at the current point. If instead one takes steps proportional to the *positive* of the gradient, one approaches a local maximum of that function; the procedure is then known as **gradient ascent**.
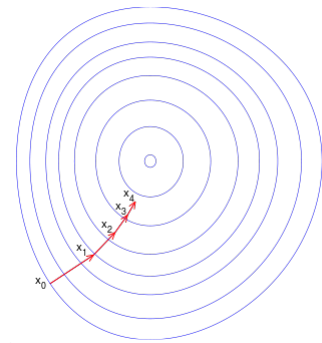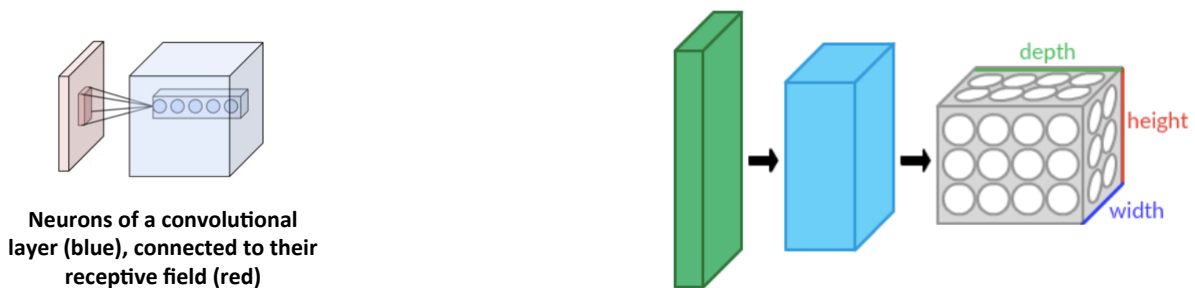
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Top Used ML/AI Techniques: Convolutional Networks

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- Convolutional Networks - In machine learning, a convolutional neural network (CNN, or ConvNet) is a class of deep, feed-forward artificial neural networks, most commonly applied to analyzing visual imagery. The convolutional layer is the core building block of a CNN. The layer's parameters consist of a set of learnable filters, that have a small receptive field, but extend through the full depth of the input volume. During the forward pass, each filter is convolved across the width and height of the input volume, computing the dot product between the entries of the filter and the input and producing a 2-dimensional activation map of that filter. As a result, the network learns filters that activate when it detects some specific type of feature at some spatial position in the input.
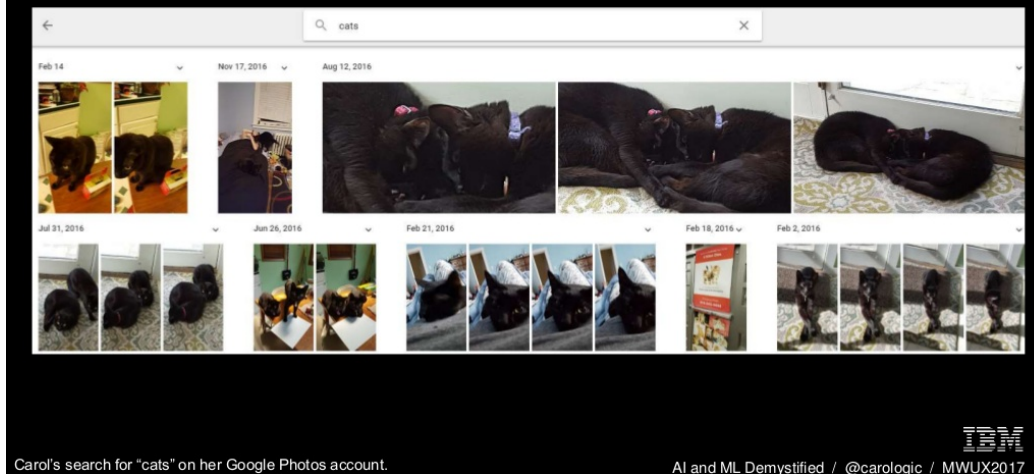
Neurons of a convolutional layer (blue), connected to their receptive field (red)

depth
height
width

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Example of ML for Image Recognition

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Image Recognition – Google Photos

Carol's search for "cats" on her Google Photos account.

AI and ML Demystified / @carologic / MWUX2017

Source: AI and ML Demystified

Top Used ML/AI Techniques: Lookahead & Backchaining

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- Lookahead & Backcahining- are the leading models for decision making as part of machine learning.
  - **Backchaining** is a technique used in teaching oral language skills, especially with polysyllabic or difficult words. The teacher pronounces the last syllable, the student repeats, and then the teacher continues, working backwards from the end of the word to the beginning.

    For example, to teach the name '**Kinsbruner**' a teacher will pronounce the last syllable: -**ner**, and have the student repeat it. Then the teacher will repeat it with -**-bru-** attached before: -**bru-ner,** after which all that remains is the first syllable: **Kins-bru-ner**.
  - The lookahead-based algorithms is used for induction of decision trees, allowing tradeoff between tree quality and learning times.

Example of ML for Sound Recognition

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Sound recognition: Labeling of birdsongs

"Comparison of machine learning methods applied to birdsong element classification"
by David Nicholson. Proceedings of the 15th Python in Science Conference (SCIPY 2016).
http://conference.scipy.org/proceedings/scipy2016/pdfs/david_nicholson.pdf
Photo by Gallo71 (Own work) [Public domain], via Wikimedia Commons https://commons.wikimedia.org/wiki/File%3ABruni.JPG

AI and ML Demystified / @carologic / MWUX2017

Source: AI and ML Demystified

Top Used ML/AI Techniques: Forward-Backward

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- Forward Backward – In an inference algorithm that computes the posterior marginals of all hidden state variables given a sequence of observations. The algorithm makes use of the principle of dynamic programming to efficiently compute the values that are required to obtain the posterior marginal distributions in two passes. The first pass goes forward in time while the second goes backward in time; hence the name *forward–backward algorithm.*

In the **first pass**, the forward–backward algorithm computes a set of forward probabilities which provide the probability of ending up in any particular state given the first observations in the sequence. In the second **pass**, the algorithm computes a set of backward probabilities which provide the probability of observing the remaining observations given any starting point. These two sets of probability distributions can then be combined to obtain the distribution over states at any specific point in time given the entire observation sequence.

```
>>> for line in example():
...     print(*line)
...
{'Healthy': 0.3, 'Fever': 0.04000000000000001} {'Healthy': 0.0892, 'Fever': 0.03408} {'Healthy': 0.007518, 'Fever': 0.028120319999999997}
{'Healthy': 0.0010418399999999998, 'Fever': 0.00109578} {'Healthy': 0.00249, 'Fever': 0.00394} {'Healthy': 0.01, 'Fever': 0.01}
{'Healthy': 0.8770110375573259, 'Fever': 0.1229889624426741} {'Healthy': 0.623228030950954, 'Fever': 0.3767719690490461} {'Healthy': 0.2109527048413057, 'Fever':
0.7890472951586943}
```

Top Used ML/AI Techniques: Forward-Backward

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```
states = ('Healthy', 'Fever')
end_state = 'E'

observations = ('normal', 'cold', 'dizzy')

start_probability = {'Healthy': 0.6, 'Fever': 0.4}

transition_probability = {
   'Healthy' : {'Healthy': 0.69, 'Fever': 0.3, 'E': 0.01},
   'Fever' : {'Healthy': 0.4, 'Fever': 0.59, 'E': 0.01},
   }

emission_probability = {
   'Healthy' : {'normal': 0.5, 'cold': 0.4, 'dizzy': 0.1},
   'Fever' : {'normal': 0.1, 'cold': 0.3, 'dizzy': 0.6},
   }
```

```python
def fwd_bkw(observations, states, start_prob, trans_prob, emm_prob, end_st):
    # forward part of the algorithm
    fwd = []
    f_prev = {}
    for i, observation_i in enumerate(observations):
        f_curr = {}
        for st in states:
            if i == 0:
                # base case for the forward part
                prev_f_sum = start_prob[st]
            else:
                prev_f_sum = sum(f_prev[k]*trans_prob[k][st] for k in states)

            f_curr[st] = emm_prob[st][observation_i] * prev_f_sum

        fwd.append(f_curr)
        f_prev = f_curr

    p_fwd = sum(f_curr[k] * trans_prob[k][end_st] for k in states)

    # backward part of the algorithm
    bkw = []
    b_prev = {}
    for i, observation_i_plus in enumerate(reversed(observations[1:]+(None,))):
        b_curr = {}
        for st in states:
            if i == 0:
                # base case for backward part
                b_curr[st] = trans_prob[st][end_st]
            else:
                b_curr[st] = sum(trans_prob[st][l] * emm_prob[l][observation_i_plus] * b_prev[l] for l in states)

        bkw.insert(0,b_curr)
        b_prev = b_curr

    p_bkw = sum(start_prob[l] * emm_prob[l][observations[0]] * b_curr[l] for l in states)

    # merging the two parts
    posterior = []
    for i in range(len(observations)):
        posterior.append({st: fwd[i][st] * bkw[i][st] / p_fwd for st in states})

    assert p_fwd == p_bkw
    return fwd, bkw, posterior
```

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Tools Landscape - Mabl

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Explore mabl ✕

</> Journeys
Journeys describe the functionality mabl will test. Train mabl to test additional functionality.
[New journey]

Plans
Plans define where and when mabl will run journeys. Create a new plan to run an existing journey using Firefox.
[New plan]

Team
Invite your teammates to help train mabl and keep up to date on test status.
[Invite teammate]

mabl Trainer
⊞ ⏮ ▶ ⏭ ● Live ⋮

1 Set viewport size to width 1547

2 Visit URL assigned to variable "app.url"

☑ 🔍 ⏱ (x) JS ▦
Hovers: ☐ Record ☐ Hide
[Save] [Cancel]

mabl Trainer

Hi! Before you get started, please:
- Log out of your application
- Clear any cookies for this application

[OK, train me!]

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Tools Landscape - Mabl

Journeys
Eran Test
DevOps

Flows
Add Login Flow

▼ Trained Test

Step 1	Set viewport size to width 1547
Step 2	Click on the link "Travel" to https://edition.cnn.com/travel
Step 3	Click on the link "FOOD & DRINK" to https://edition.cnn.com/travel/food-and-drink
Step 4	Click on the <div> element with text "Search"
Step 5	Click on the "Search" text field
Step 6	Enter "Sushi" in the "Search" text field
Step 7	Send " [ENTER] " keypress to the "Search" text field
Step 8	Click on the link "Tokyo" to https://edition.cnn.com/travel/destinations/tokyo
Step 9	Click on the link "STAY" to https://edition.cnn.com/travel/stay
Step 10	Click on the <div> element with text "Airbnb cancels Great Wall of China sleepover contest"

Plans that include this journey
Select plans...
This journey is a member of the following plans.

Plan	Application	Environment	Last Status	Last Started ↑	Last Finished	Last Run Time	View Output
CNN	⊞ CNN	◉ ENV					

Tools Landscape - Testim

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Tools Landscape – Testim testim

Tools Landscape – Test Craft test craft

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Tools Landscape – Applitools
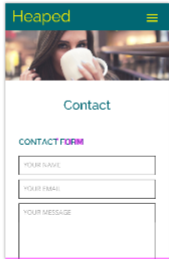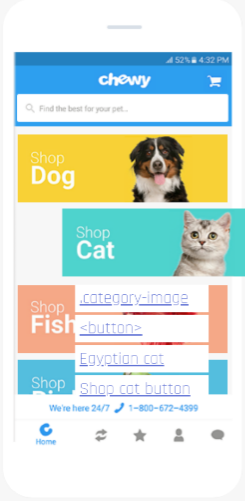
Tools Landscape – Test.AI
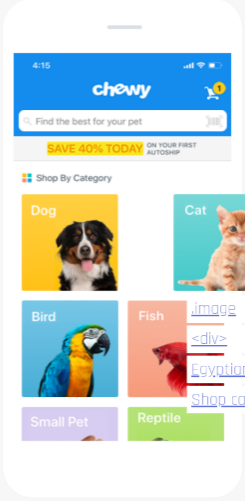
Let AI Handle Your Test

MATCH

AI just like a real person, **IDENTIFIES** the screens and elements in your app

AI EXECUTES user scenarios—test on-demand whenever you're ready

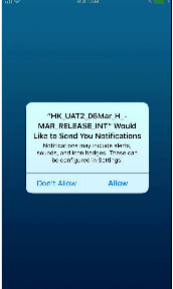**AI RECOGNIZES** elements, so that even if things change, your test don't break.
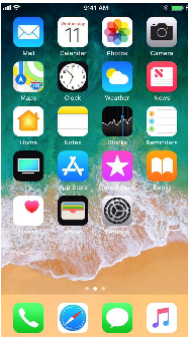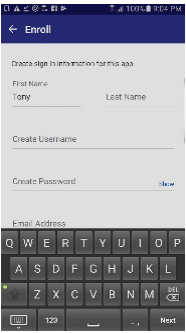
How To Find False Negatives

- Pop up
- Home screen
- Keyboard open

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Error Classification and Test Productivity

Automation Success Rate
demo.perfectomobile.com | 2018-06-20
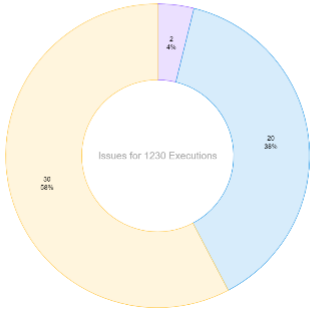
| 37% Last 24h | 91% Last 7d | 91% Last 14d |

What is impacting my automation success rate?

Issues for 1230 Executions

- Lab
- Orchestration
- Scripting

How to increase success rate by 63%

#	Recommendation	Impact
1	Replace iPhone-5S (544cc6c6026af23c11f5ed6387df5d5f724f60fb) due to errors	-30%
2	Use smart check for busy devices	-15%
3	Remediate TransferMoney test	-12%
4	XPath /bookstore/book[1]/title is broken (affects 30 tests)	-6%
5	Ensure tests use Digitalzoom API	Eliminate 720 Unknowns

Top 5 failing tests (maturity > 3 days)

#	Test	Age	Failures	Passes
1	TransferMoney	56d	75	0
2	FindBranch	56d	71	3
3	HonkHorn	56d	68	13
4	InsuranceSearch	56d	7	0
5	RemoteStart	56d	41	25

Top 5 problematic devices

#	Model	OS	ID	Passes	Failures	Errors
1	iPhone-5S	iOS 9.2.1	544cc6c6026af23c11f5ed6387df5d5f724f60fb	0	25	10
2	Galaxy S5	Android 5.0	B5DED881	0	23	23
3	Galaxy Note III	Android 4.4	61F1BF00	1	15	10
4	Nexus 5	Android 5.0	0682593600741B8B	2	13	9
5	iPhone-6	iOS 9.1	6E1CBC7E90168A3A7CFDA2712A8C20DD15517F89	2	12	8

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Role and Skillset

- Change in mind set – Aid Humans vs. Replacing Humans
- Training on modern ML/AI tools and techniques
- Use the tools to solve complex testing activities
- Keep humans in control of these tools, evolve productivity
- Modify working processes accordingly (Go/No GO criteria?)

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Summary

- Start exploring AI/ML tools today (Dev and Test)
- Clearly (today), AI/ML tools are solving specific rather than holistic problems
- Match AI/ML tools to existing pains and bottlenecks (Automation, analytics)
- Start small and grow (Web, Mobile, Both)
- Calm Down

KEEP CALM AND LEARN MACHINE LEARNING
KeepCalmAndPosters.com

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Thank You

Eran Kinsbruner

@ek121268

erank@perfecto.io

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