Machine Learning

And the Peak of Inflated Expectations

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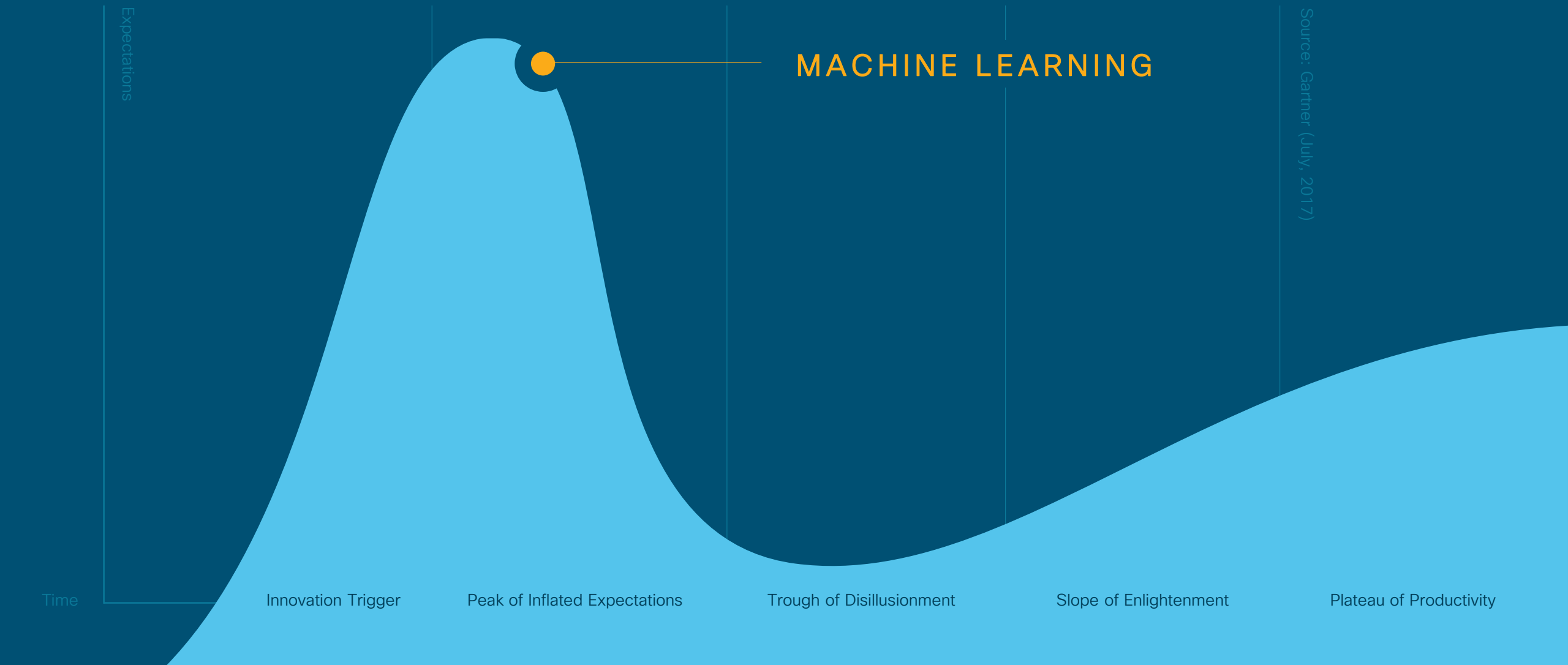
Distinguished Engineer
June 2018

Gartner Hype Cycle for Emerging Technologies | 2017



Vendors Got Us Here

"Advanced Threats are no match for A.I."

"Our machines detect threats others cannot"

"100% predictive"

How We Disservice Machine Learning

Silver Bullet Marketing

No Explanation or Discussion

Limited Guidance

MACHINE LEARNING

What it is

*“Field of study that gives computers the ability to learn **without being explicitly programmed.**”*

Arthur Samuel’s definition of machine learning in 1959

instance based

clustering

regularization

ensemble

bayesian

rule system

ground truth

machine learning algorithms

classifier

regression

decision tree

deep learning

neural network

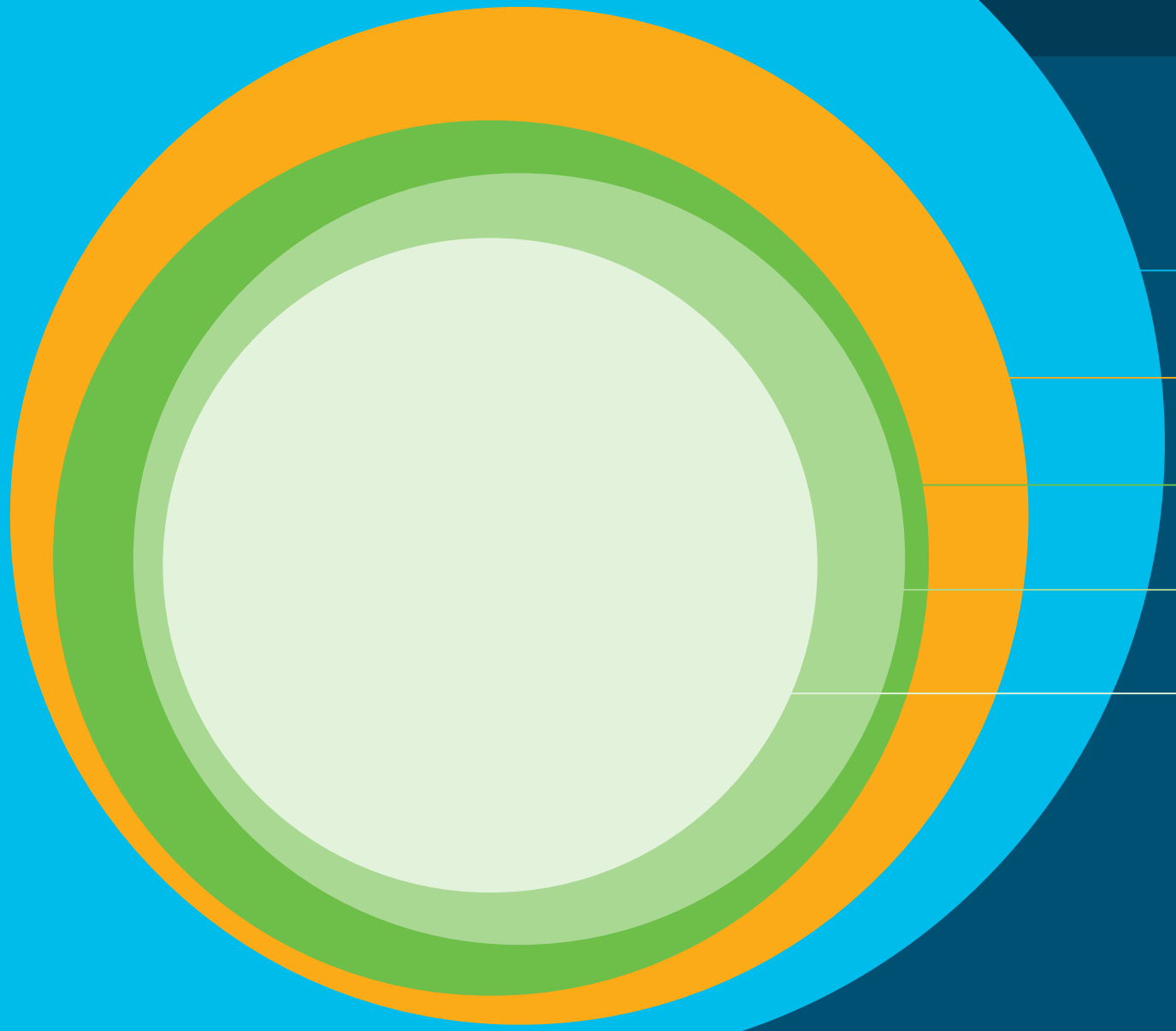
dimensionality reduction

NERD ALERT

Let's define the helpful data science terms

Machine Learning

The Big Picture



Machine Learning

Common Techniques

Supervised Learning

When you know the question you are trying to ask and have examples of it being asked and answered correction

Unsupervised Learning

You don't have answers and may not fully know the questions

Reinforcement Learning

“The other” category
Trial and error behavior effective in game scenarios

Supervised Learning

Unsupervised Learning

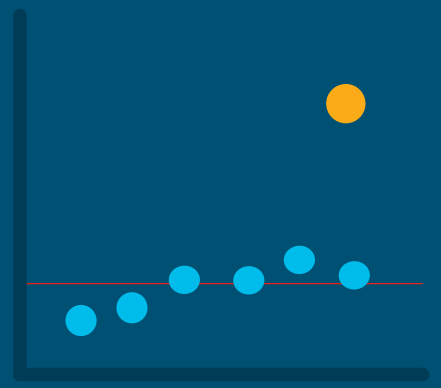
Other

(Reinforcement Learning, etc.)

What did we do before Machine Learning?

Use in combination with Machine Learning

Simple Pattern Matching



Statistical Methods

Rules and First Order Logic (FoL)

MACHINE LEARNING

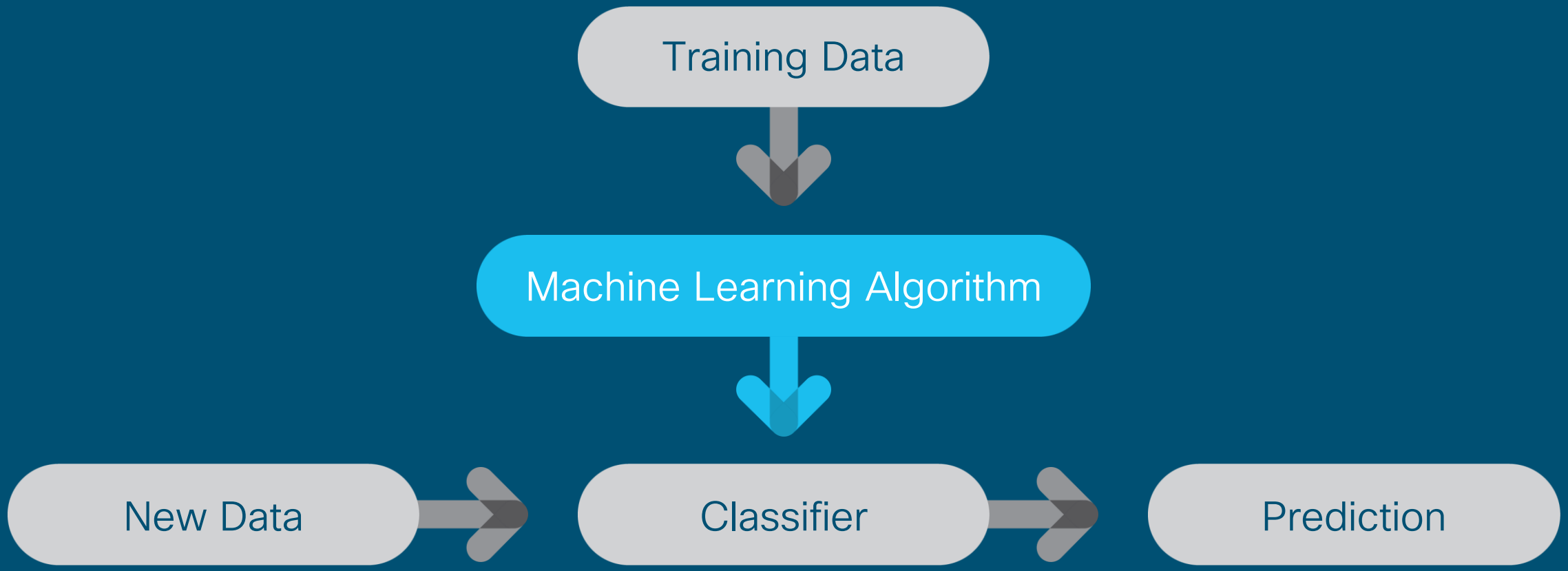
Techniques

"Field of study that gives computers the ability to learn without being explicitly programmed."

Translation

"Field of study that gives computers the ability to be implicitly programmed."

Training Classifiers



Ground Truth Used in Supervised Learning

The **'Ground Truth'** is the pairing of example questions and answers.

If you can phrase a problem as *'we know this is right, learn a way to answer more questions of this type'*.

Success depends greatly on the dataset expressing the Question -> Answer mapping.

MACHINE LEARNING

Pitfalls

One Size Does Not Fit All

Other ML Application ≠ Security

NERD ALERT

Warning: Success in one domain does not guarantee success in another

What Is At Stake Matters

Because you watched Deadpool, you might like...

Deadpool

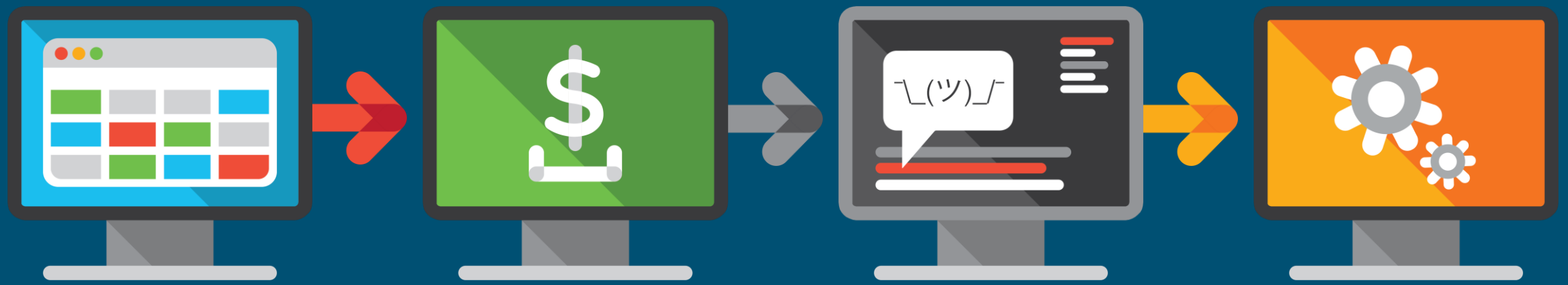
X-Men: First Class

The Flash

Captain America:
The First Avenger

How did you come to that conclusion?

"The Explainability Problem"



Normal Workflow

CFO daily calendar

Irregular Activity

ML detects "suspicious" activity and suggests remediation

Quarantined

However, ML cannot articulate *why* it wants to remediate

Loss of time and resources

MACHINE LEARNING

For Security

How We Know Machine Learning is Working

Accuracy

How often does my classifier give me the correct answer?

Precision

When my classifier predicts an instance in a certain class, how often does the instance belong to that class?

NERD ALERT

Root mean square error & Logical Regression

Translation: On average, how far away are my predictions from what we later know to be true values?

Why is Machine Learning so useful in Security?

Static

With limited variability or is well-understood

Evolving Security

The security domain is always evolving, has a large amount of variability, and is not well-understood

Insider Threats and Behavioral Security Analytics

Attackers

They're not breaking in, they are logging in

Detecting

Through novelty and outliers

Events

Turn weak signals into a strong one

Classify the Observable World and Infer the Rest

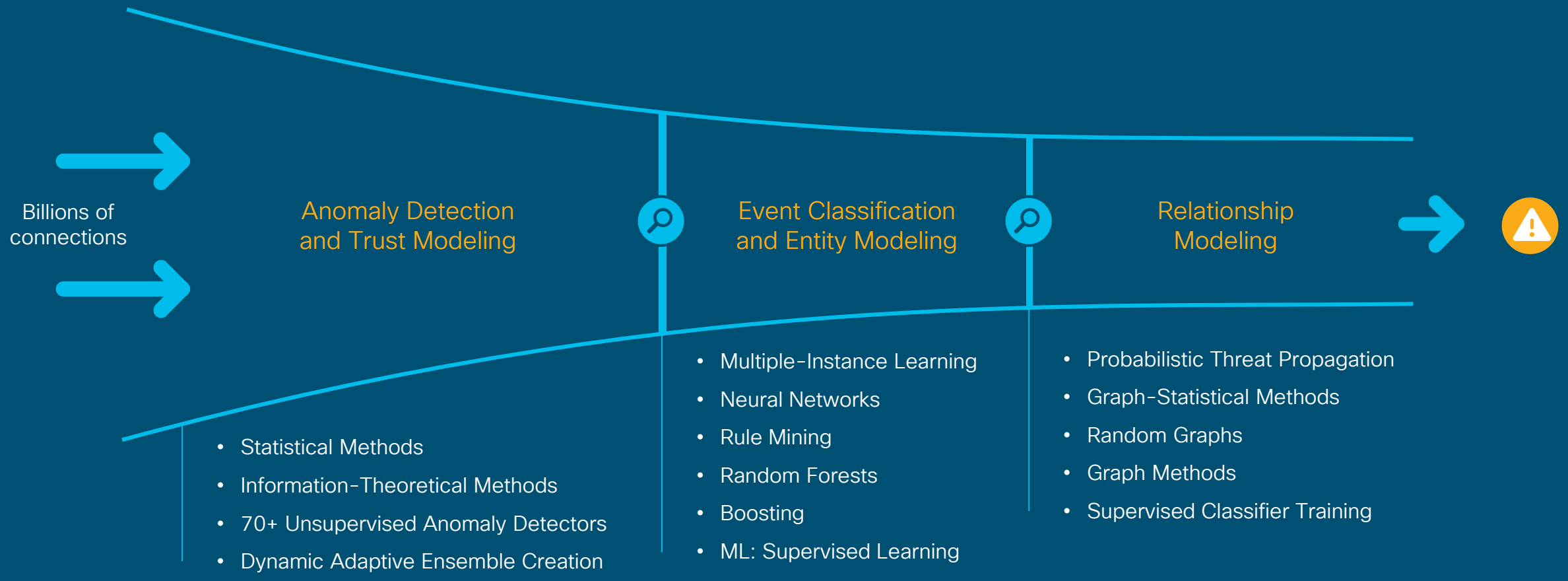
Threat Actor Activity

Weird Stuff (but not threat related)

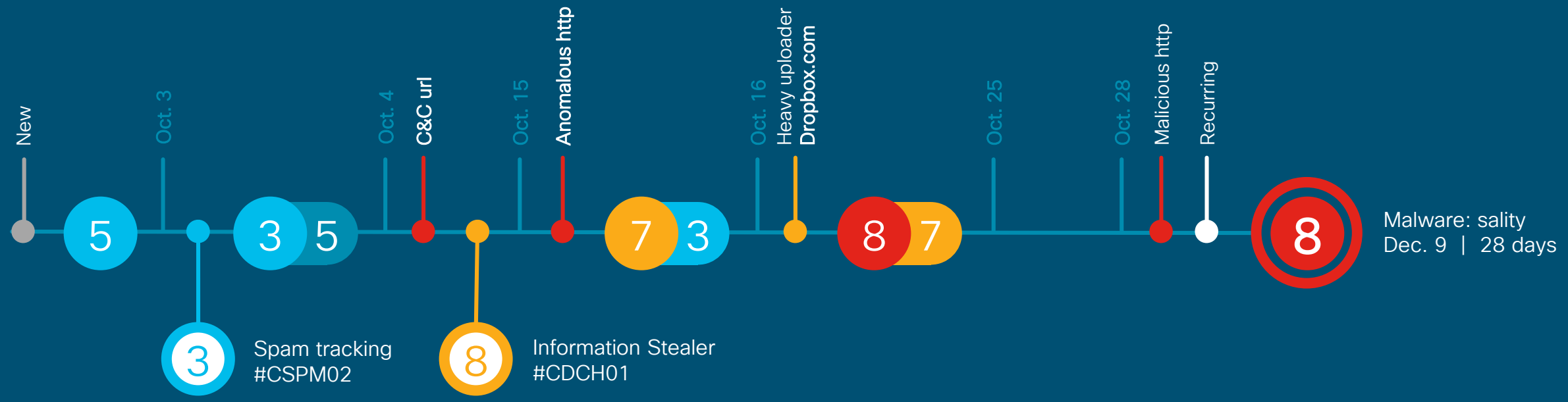
Normal Activity

Multi-layer Analytical Pipeline

Cascade of specialized layers of Machine Learning algorithms



Security that Shows its Work



Measure the Right Things

Efficacy of the Assertions

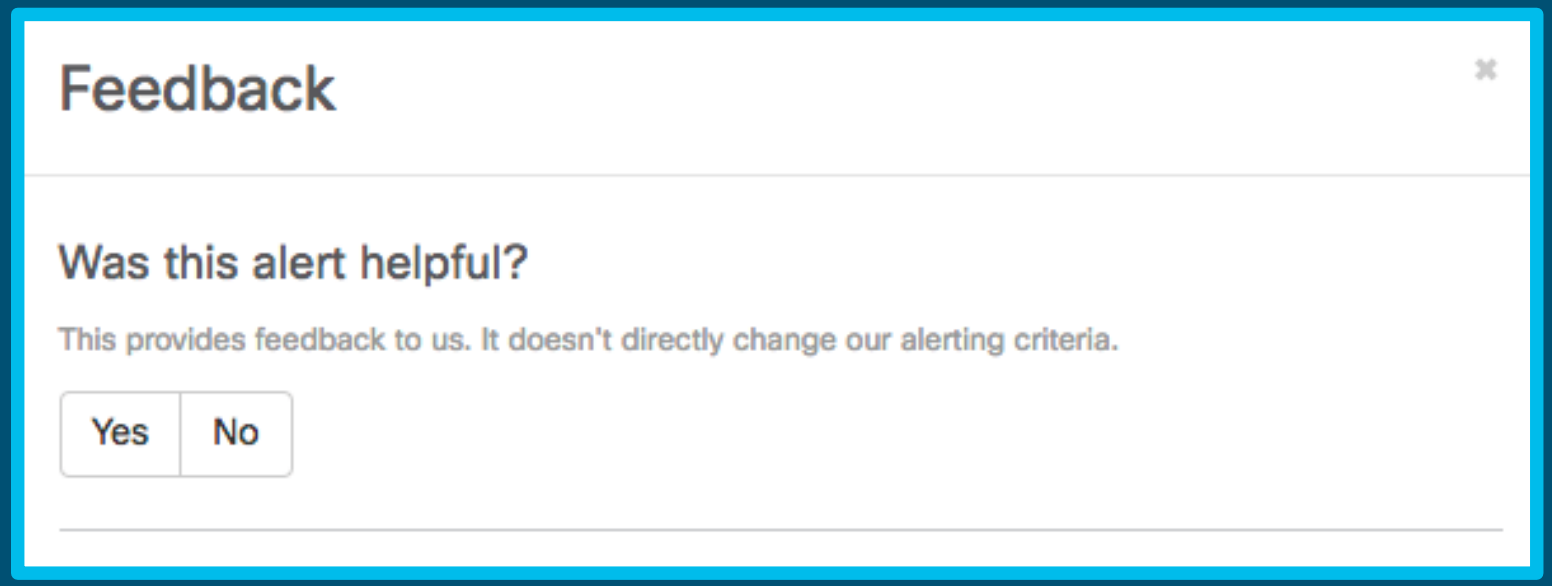
True/False Positive

True/False Negative

Overfitting/Undefitting

Root Mean Squared Error

Measure the Right Things



Conclusion

What to Ask Your Vendor

How are you applying Machine Learning in your product and why?

How do you measure its effectiveness?

Regarding supervised learning, what are you using for ’ground truth’?

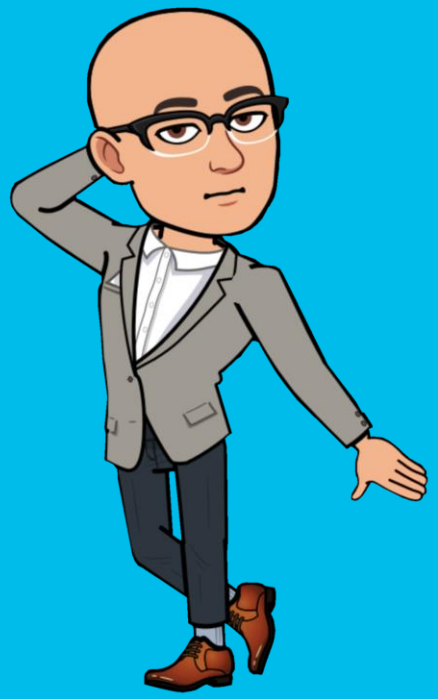
What non-machine learning are you using and why?

What papers or open-source have you published regarding your analytics?

For the ML based assertions, what entailments are provided?

A Good Machine Learning Approach

- Be Pragmatic
- Entailments
- Analytical pipeline, over single technique
- Success is Domain Specific
- Measure helpfulness, not mathematical accuracy



NERD ALERT

Thank you!