Machine Learning

Splunk4Rookies | Primer

Forward-looking statements

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splunk> a CISCO company

Splunk AI Adoption Journey

Strategy

Planning

- AI Adoption Strategy Workshop — Coming soon...
- AI for Leaders — Coming soon...

Implementation

- PS AI/ML Activation Services for Security — Coming soon...

Review

- AI Adoption Strategy Workshop

Hands-on Enablement

Level 0

- Splunk4Rookies ML - Primer
- Splunk4Rookies - Machine Learning Event Workshop

Level 1

- Splunk4Rookies ML - Security
- Splunk4Ninjas ML - Security
- Splunk4Rookies ML - IT Ops
- Splunk4Ninjas ML - AI Ops
- Splunk4Rookies ML - Business — Coming Soon...
- Splunk4Ninjas ML - Business — Coming Soon...

Level 2

- Machine Learning and Data Science Hands-on

Level 3

- Actionable Insights with Splunk and AWS

Agenda

- ❑ What is Machine Learning
- ❑ How Splunk Drives Machine Learning
- ❑ Hands-on
- ❑ Wrap Up and Next Steps

Leading Initiatives Driving ML Adoption

200%

Increase in proactive detection of security and performance issues, significantly reducing downtime

2.1x

More likely to have automated processes for alerts, helping operationalize data at scale

$365k/hour

On average saved from costly outages, helping organizations protect against revenue loss

Sources:
Harvard Business Review - Artificial Intelligence for the Real World Digital Enterprise Journal Report: The Roadmap to Becoming a Top Performing Organization in Managing IT Operations

Obstacles Blocking ML Adoption

1.8x

Increase in data and events to process every two years, creating challenges in handling data volume

1 in 2

Companies increase the number of data silos, leading to difficulties integrating ML in isolated systems

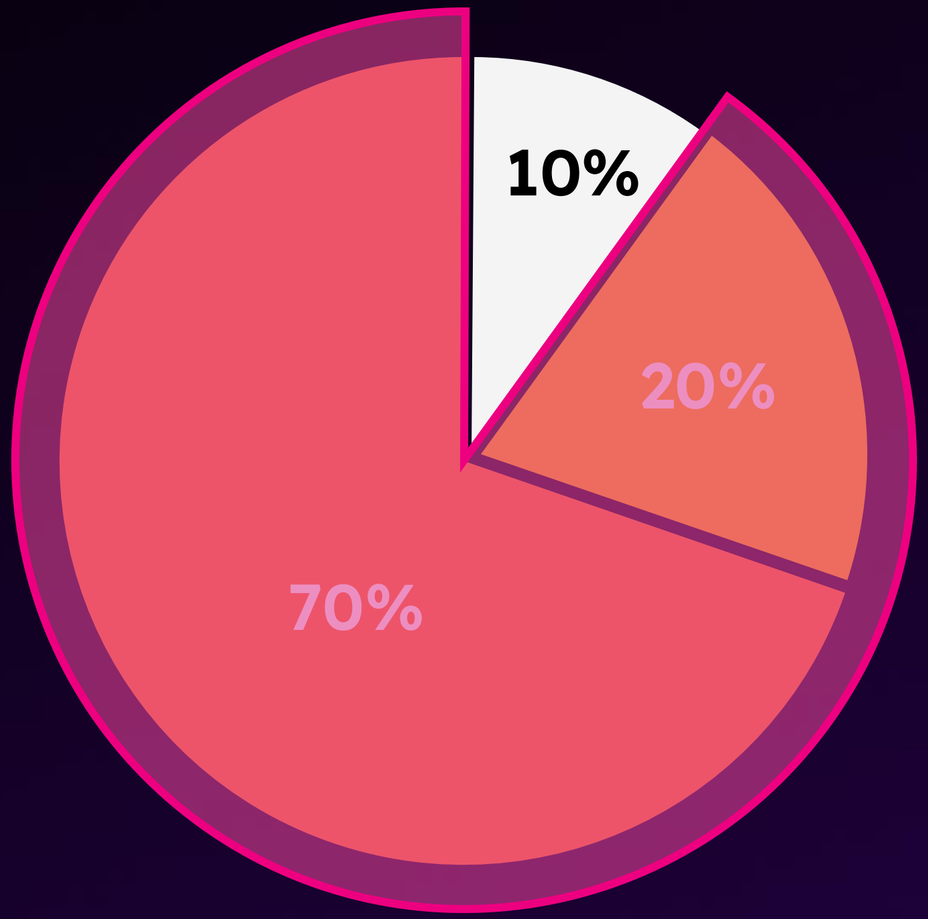
79%

Failure rate for companies which try to implement machine learning from scratch, due to lack of expertise

Sources:
Harvard Business Review - Artificial Intelligence for the Real World
Digital Enterprise Journal Report: The Roadmap to Becoming a Top Performing Organization in Managing IT Operations

https://www.xplm.com/news/press/industry-study-2023-companies-cannot-control-their-data-silos/

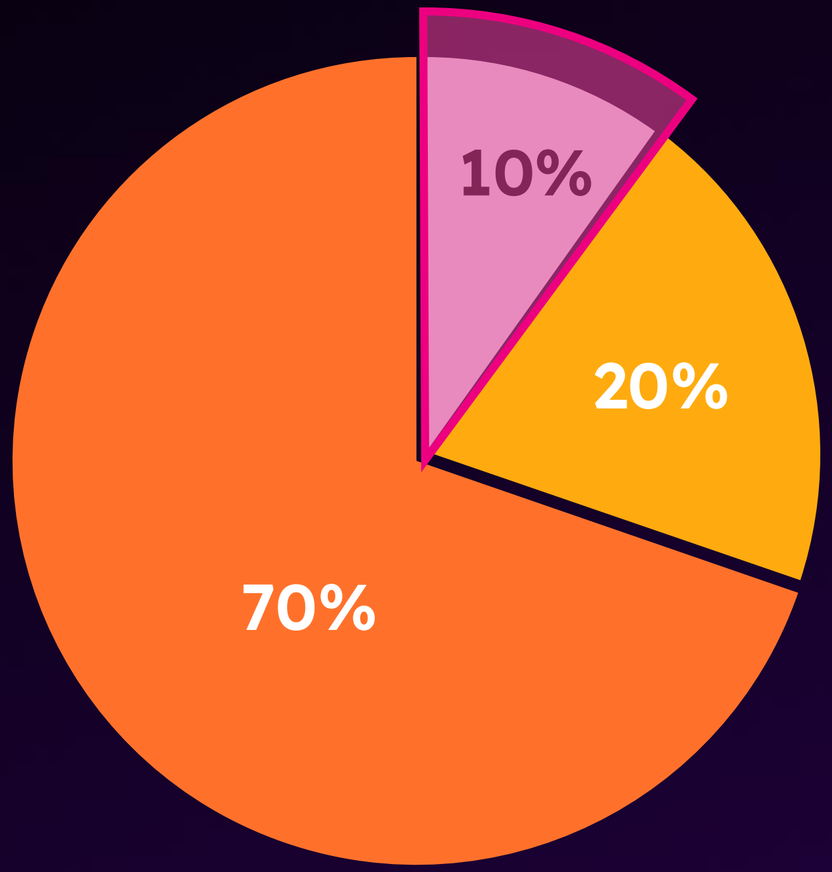
How Data Scientists Spend Their Time



- Data Engineering
- Machine Learning
- Other

Data originated from “Cleaning Big Data: Most Time-Consuming, Least Enjoyable Data Science Task, Survey Says”, Forbes Mar 23, 2016".

How Data Scientists Spend Their Time



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- Other

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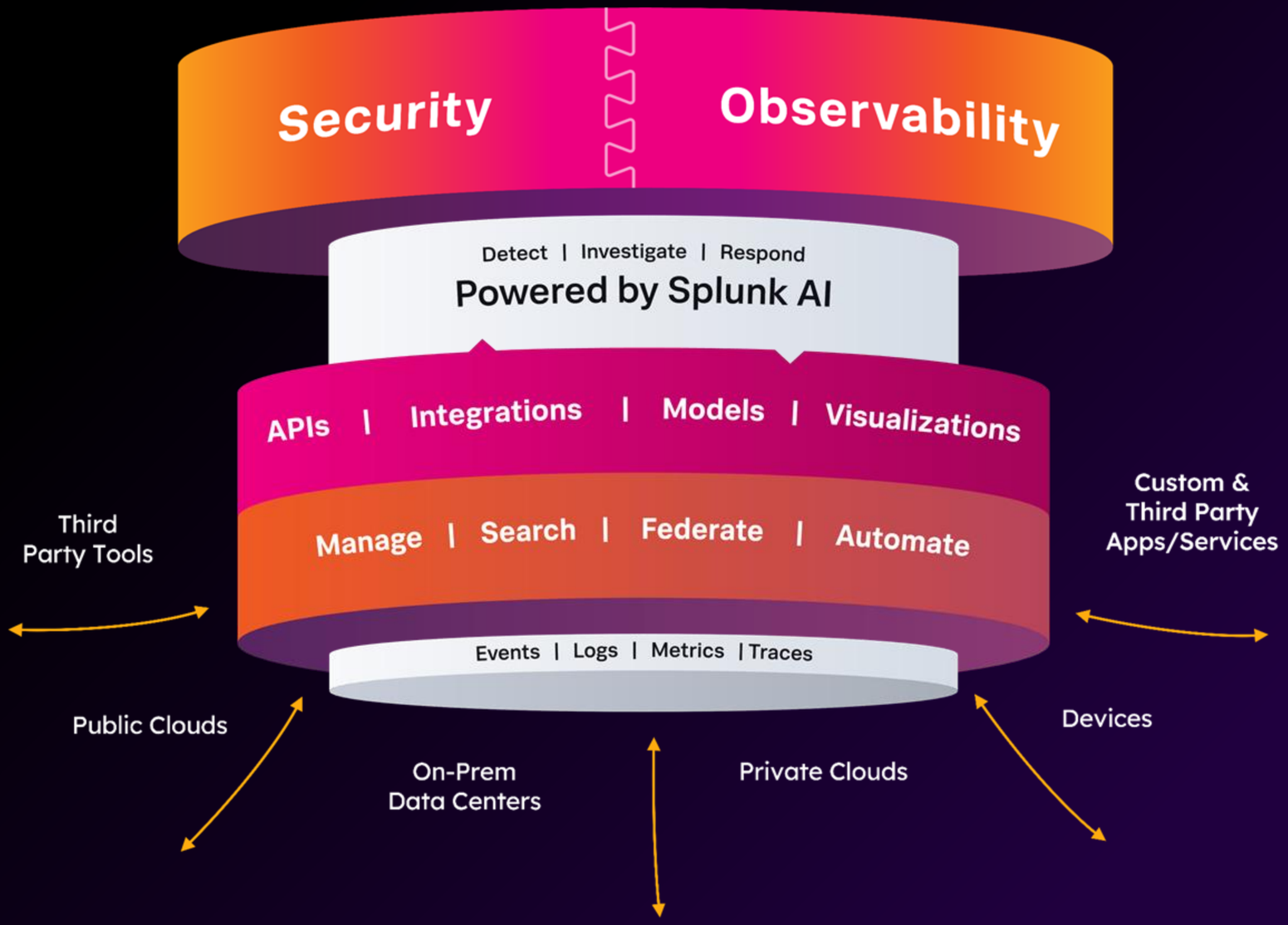
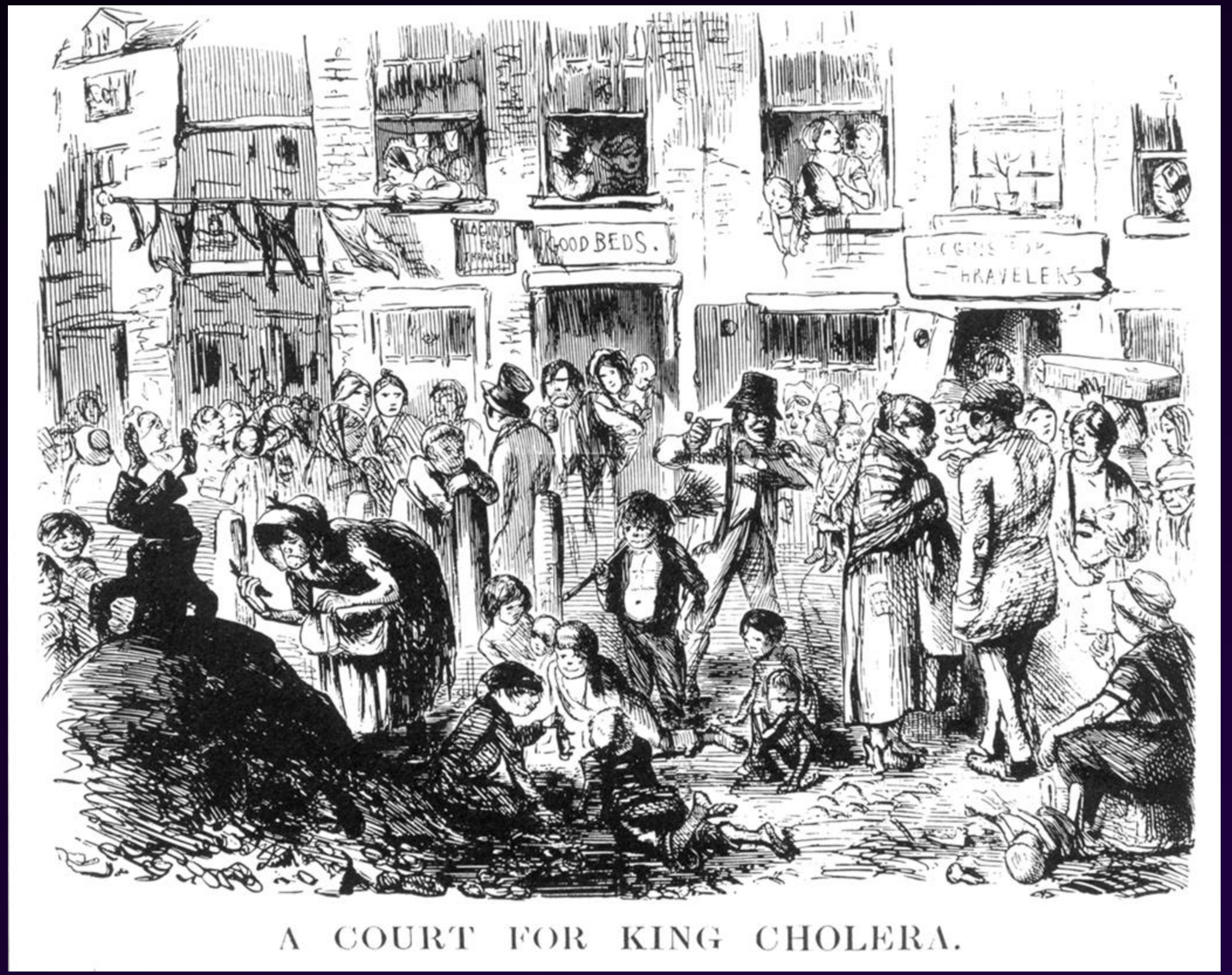
The Unified Security and Observability Platform

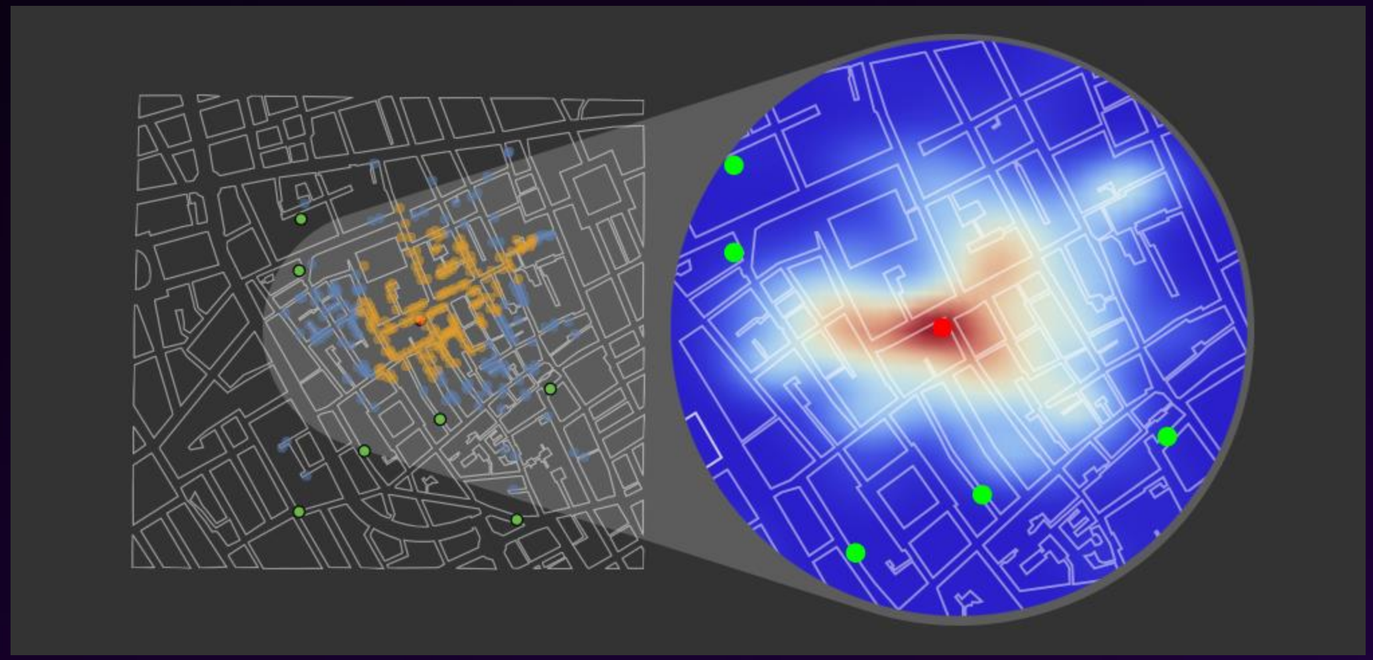


Why Data Science?

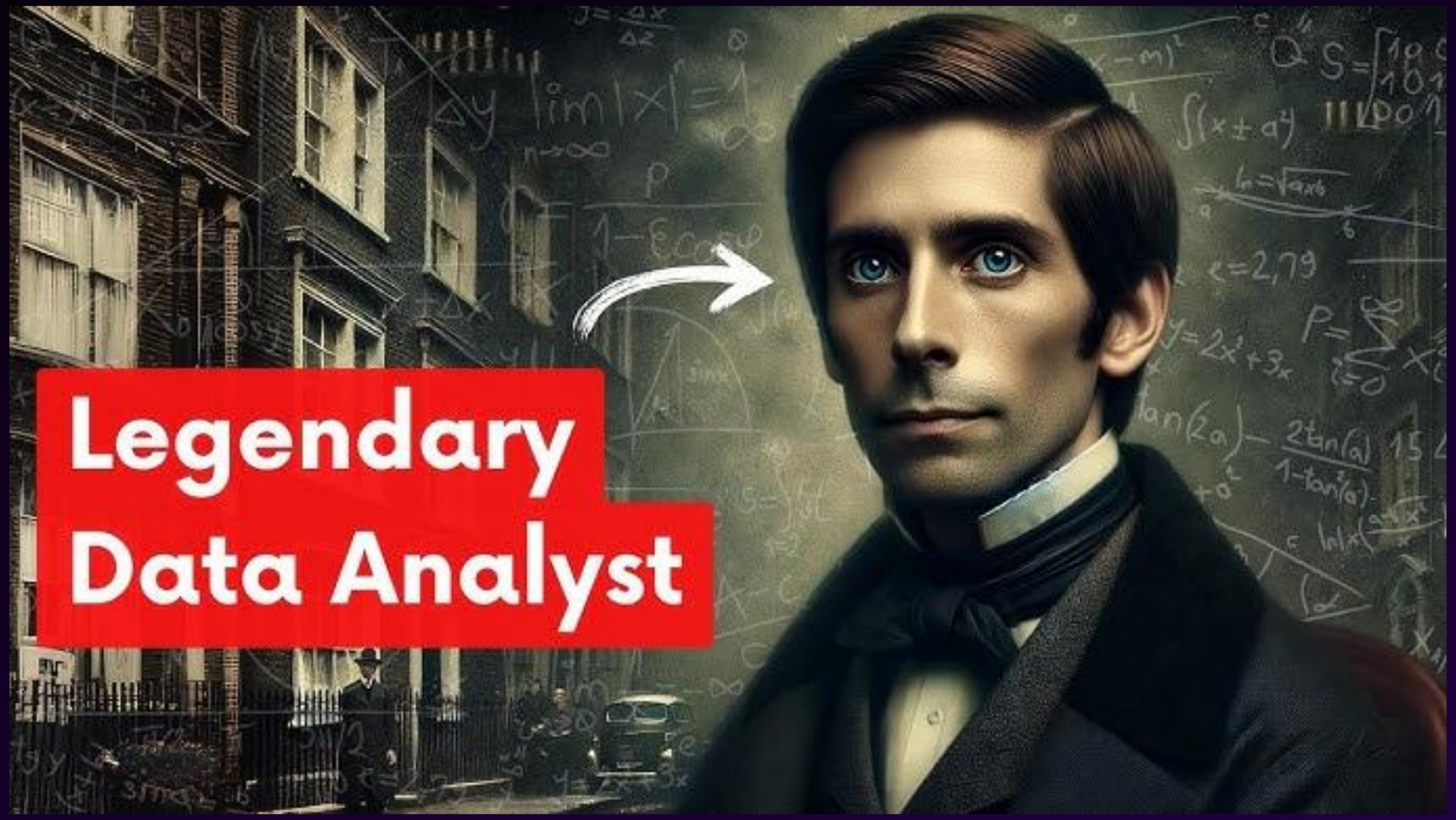


A COURT FOR KING CHOLERA.

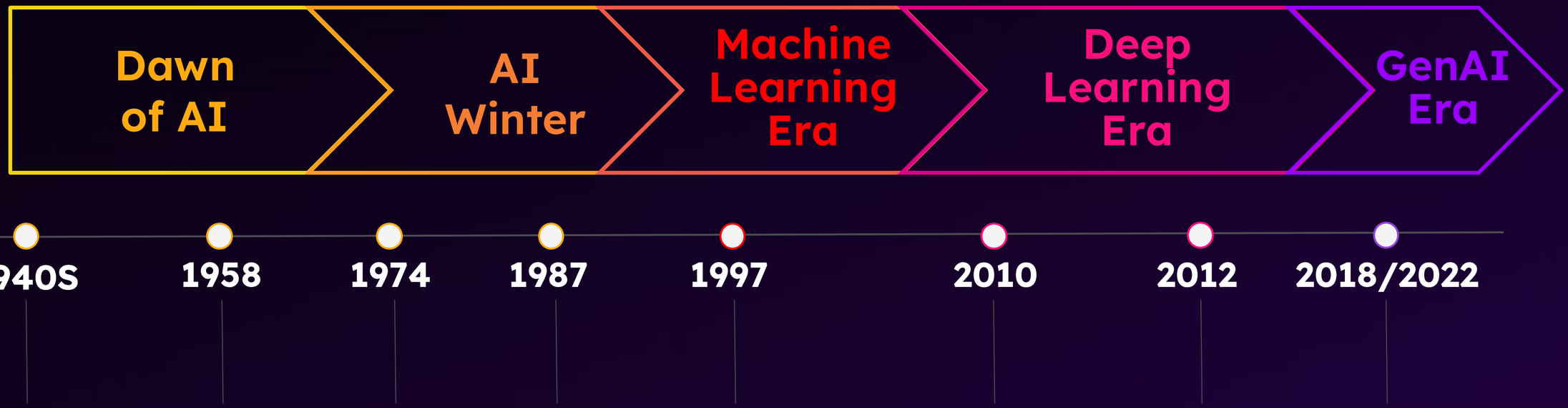
Clustering



The source!

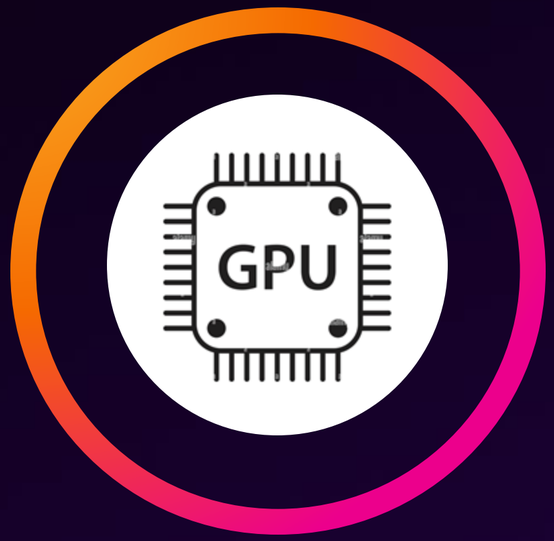


History of AI



What is driving the explosive growth of AI?

Algorithm



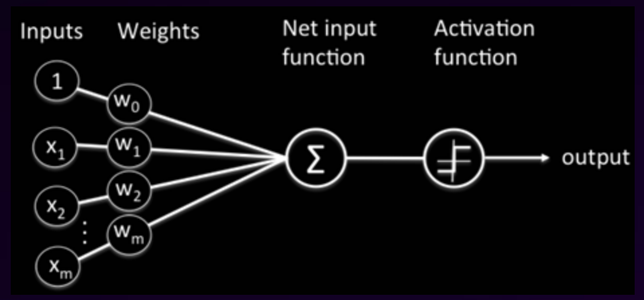
Compute

Data

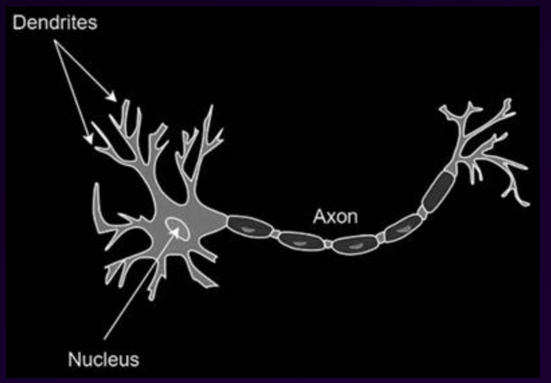
What is driving the explosive growth of AI?

Algorithm

1950's

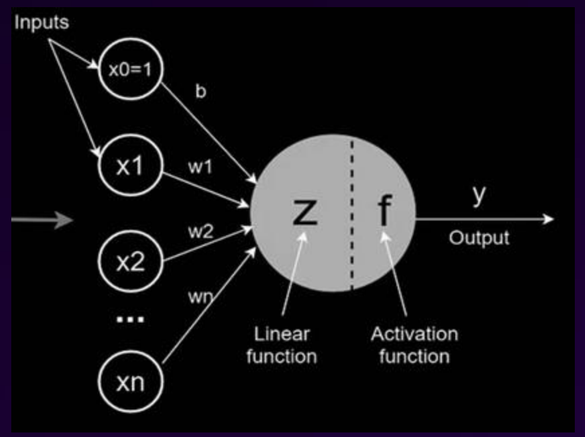


Perceptron

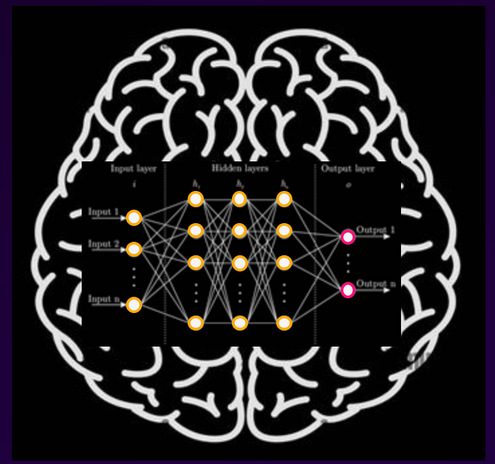


Biological Neuron

2010's



Artificial Neuron

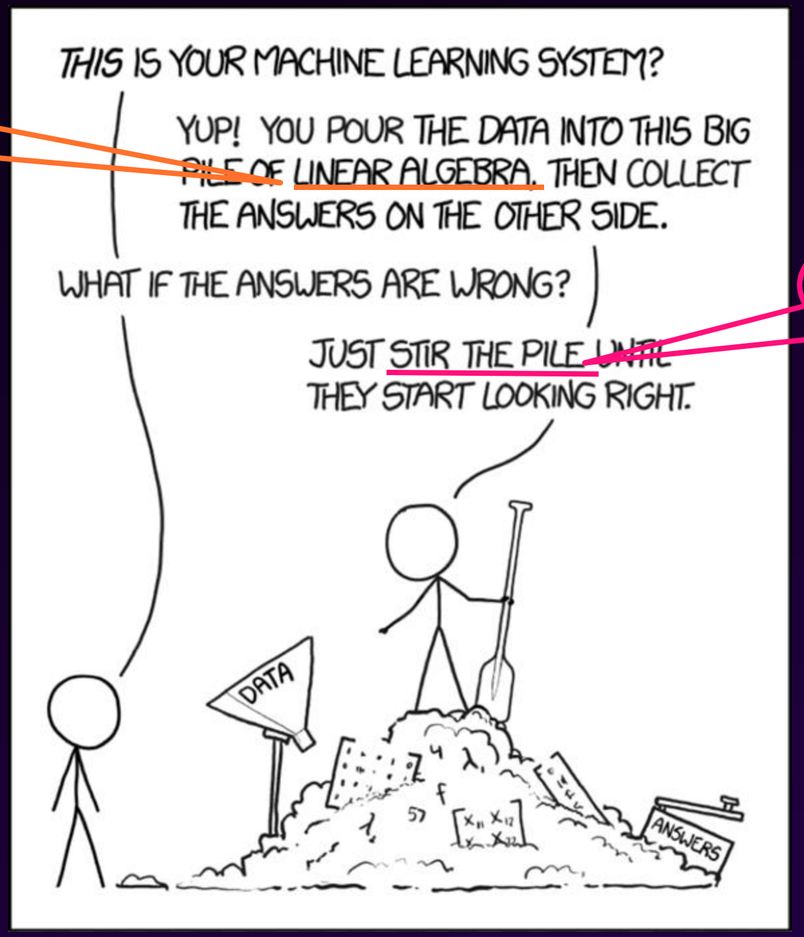


Deep Neural Network

What is driving the explosive growth of AI?

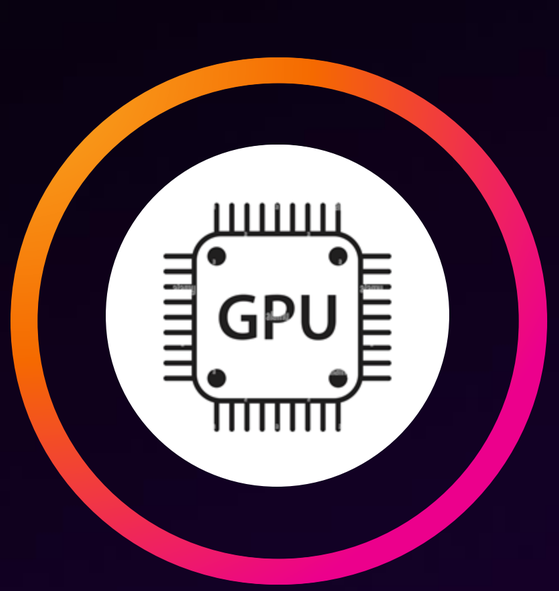
Algorithm

Matrix Multiplication

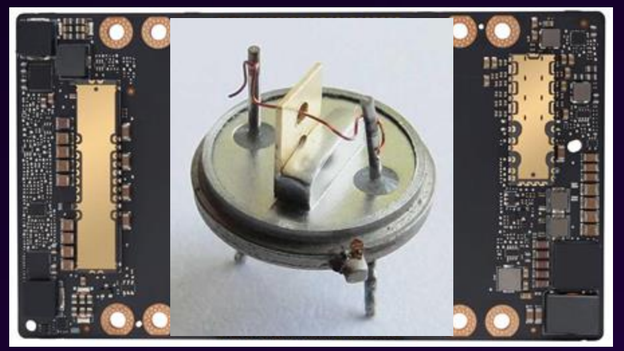


Backpropagation

What is driving the explosive growth of AI?



Compute



Cloud

What is driving the explosive growth of AI?

Data

Google

Different Levels of Teaching Machines

Artificial Intelligence

The broad study of teaching a computer to process data and make decisions

Different Levels of Teaching Machines

Artificial Intelligence

The broad study of teaching a computer to process data and make decisions

Machine Learning

Subset of AI. Predictions and insight with minimal human interference

Different Levels of Teaching Machines

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Deep Learning

Subset of ML. Predictions via neural networks

Different Levels of Teaching Machines

Artificial Intelligence

The broad study of teaching a computer to process data and make decisions

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Subset of AI. Predictions and insight with minimal human interference

Deep Learning

Subset of ML. Predictions via neural networks

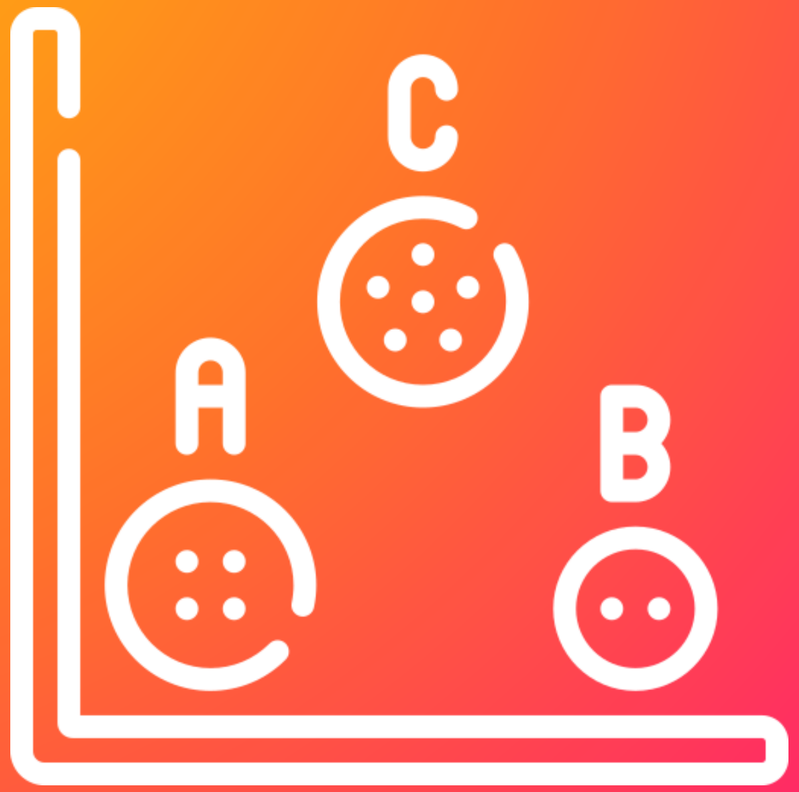
Predictive Algorithms

Methods that help you get ahead of issues that may happen in the future

Includes:

- Numerical Regression
- Categorical Regression
- Time Series Forecasting

Source: Parzival 1997, flaticon.com



Categorization Algorithms

Uncover insights about your data to quickly respond in the present

Includes:

- Categorical Regression
- Clustering

Source:Freepik, flaticon.com

Outlier Detection Algorithms

Identify and analyze abnormal behavior in your data

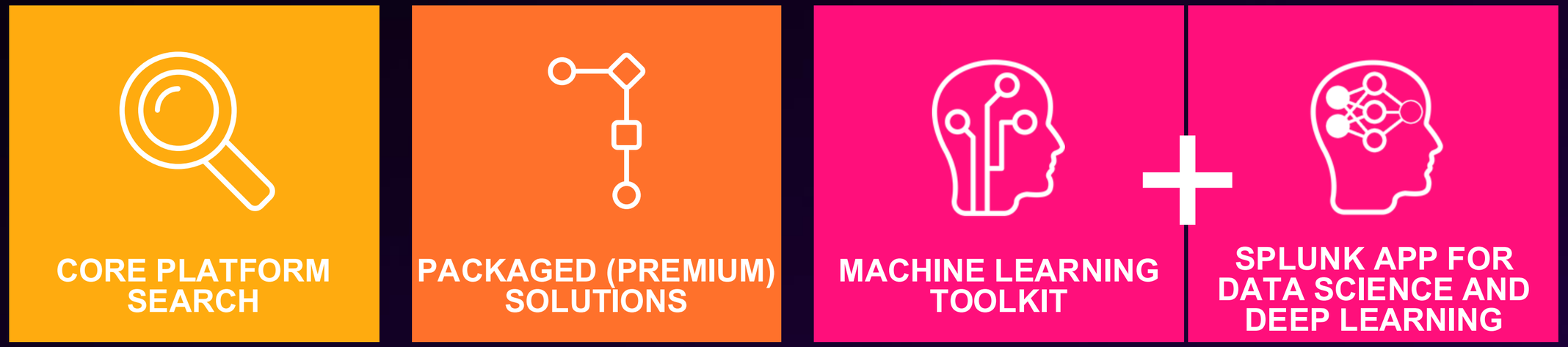
Includes:

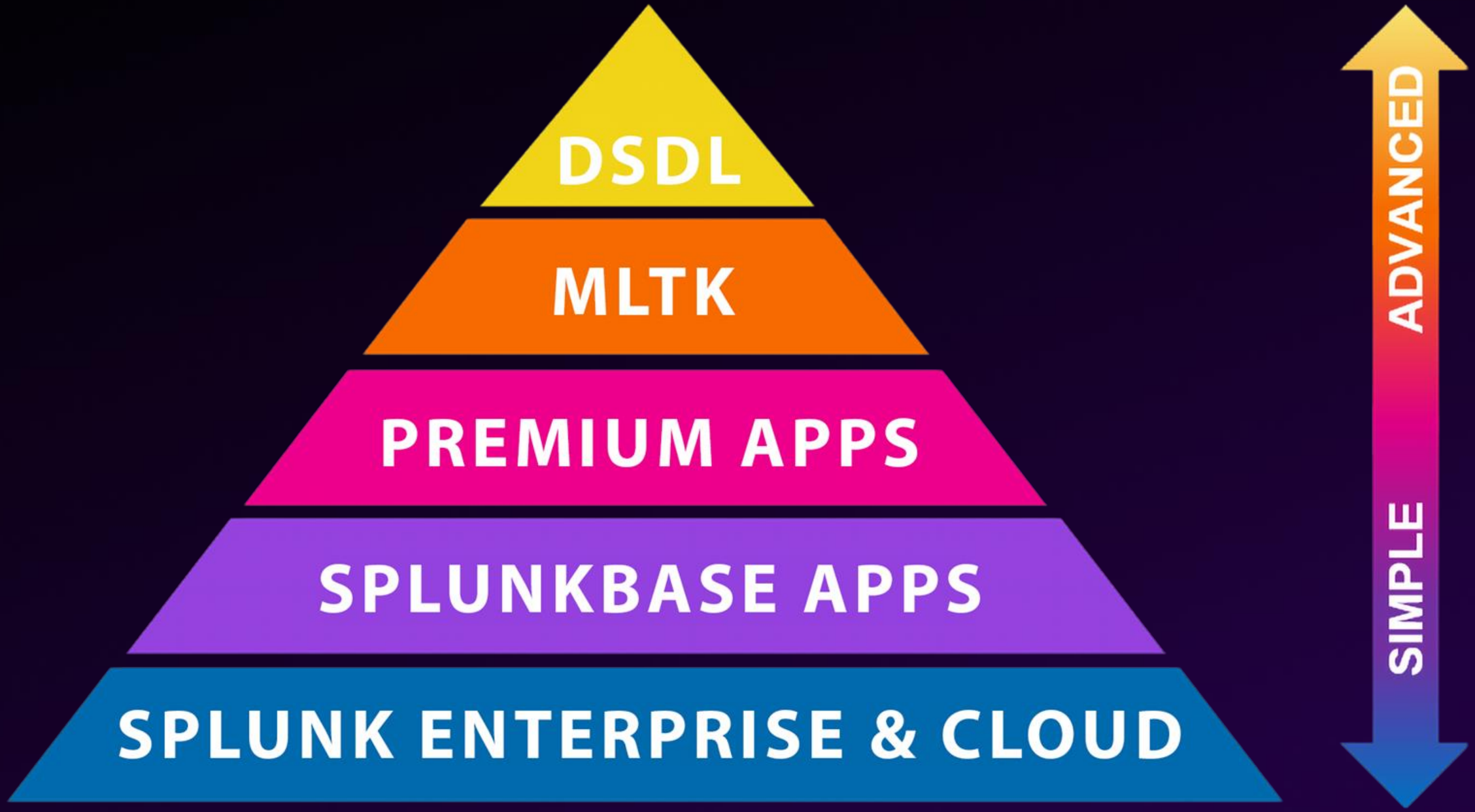
- Clustering
- Outlier Detection

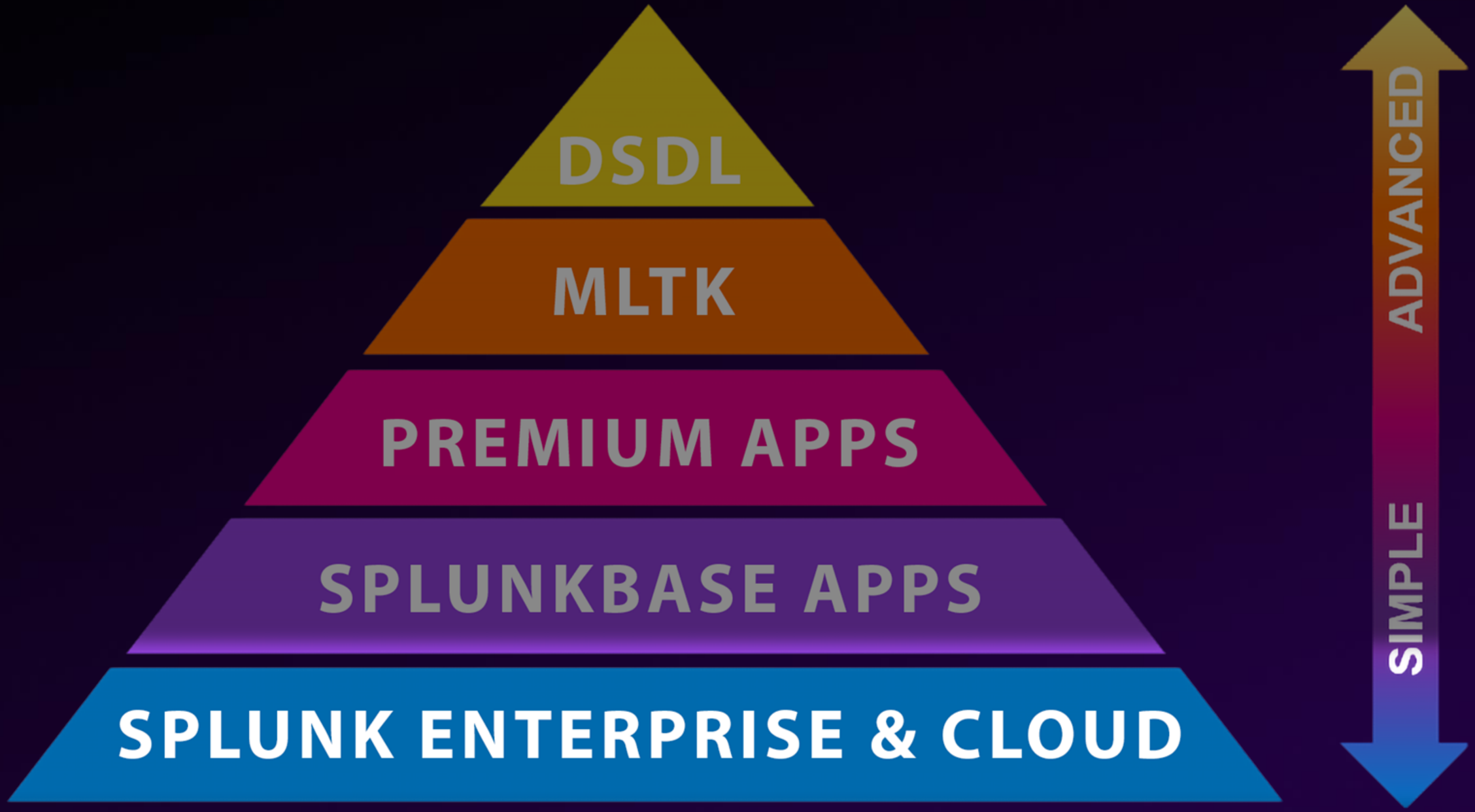
Source:Hajicon, flaticon.com

Splunk ML & AI

Where to find ML

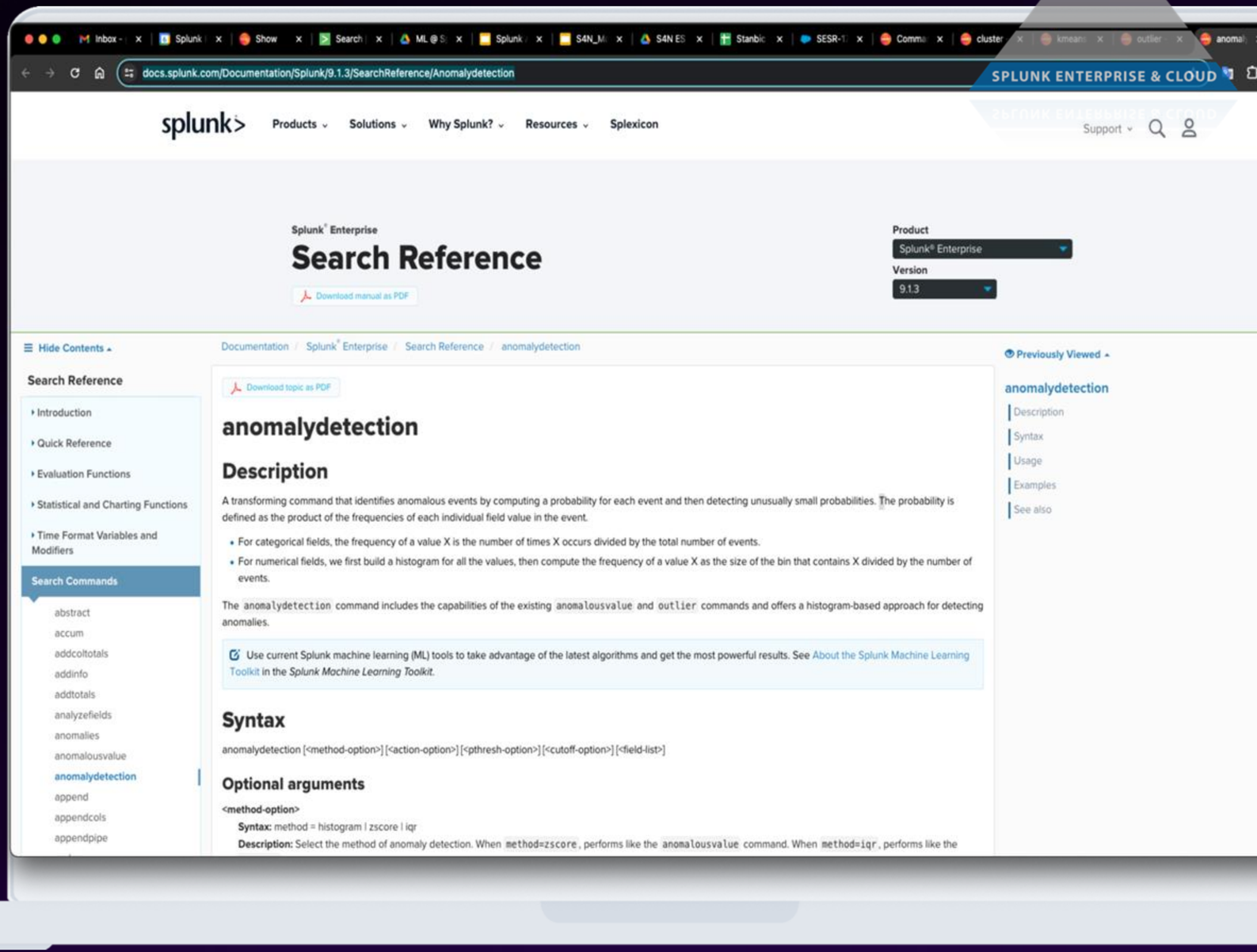






|anomalydetection

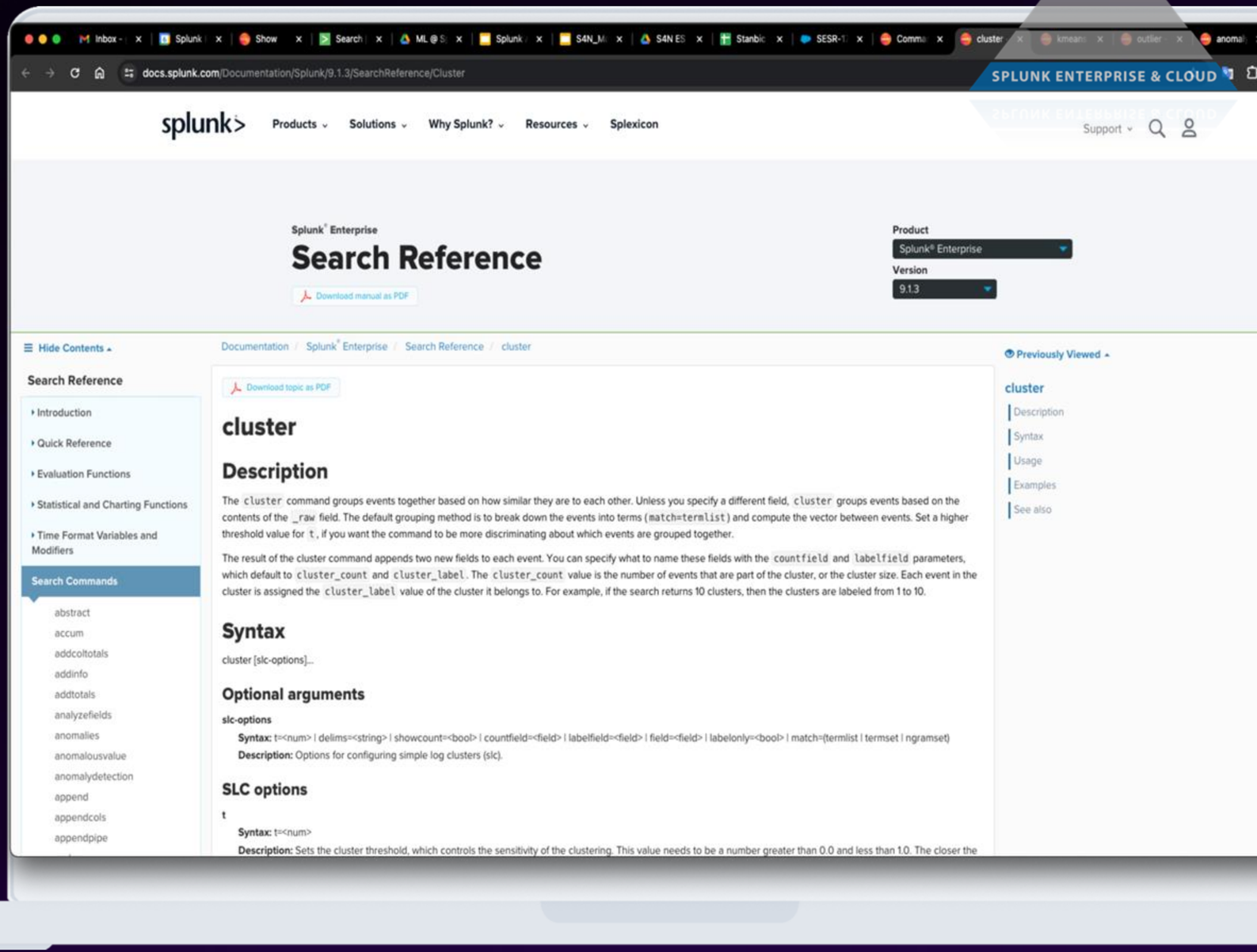
A transforming command that identifies anomalous events by computing a probability for each event and then detecting unusually small probabilities.



https://docs.splunk.com/Documentation/Splunk/latest/SearchReference/Anomalydetection

|cluster

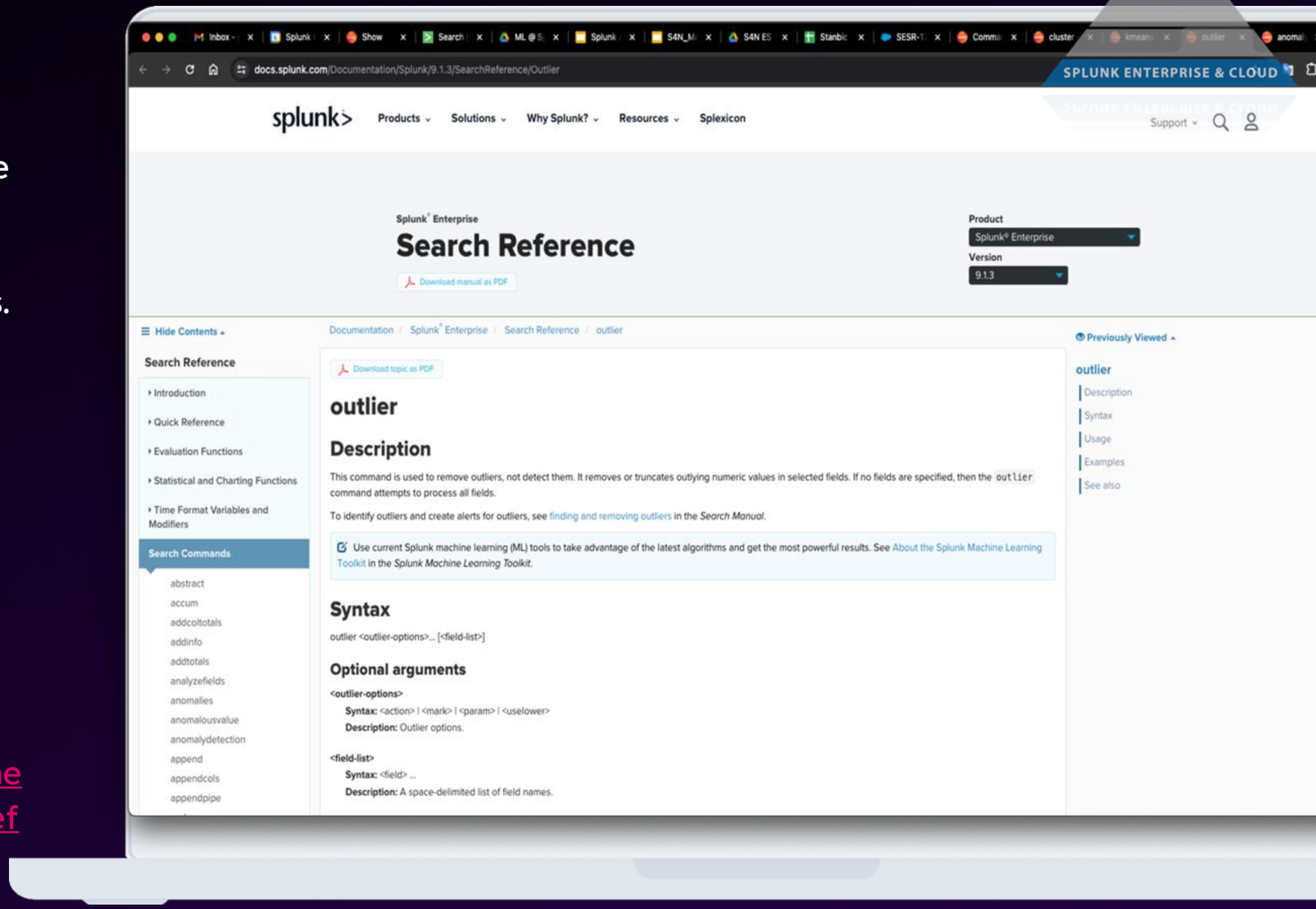
The cluster command groups events together based on how similar they are to each other.



https://docs.splunk.com/Documentation/Splunk/latest/SearchReference/Cluster

|outlier

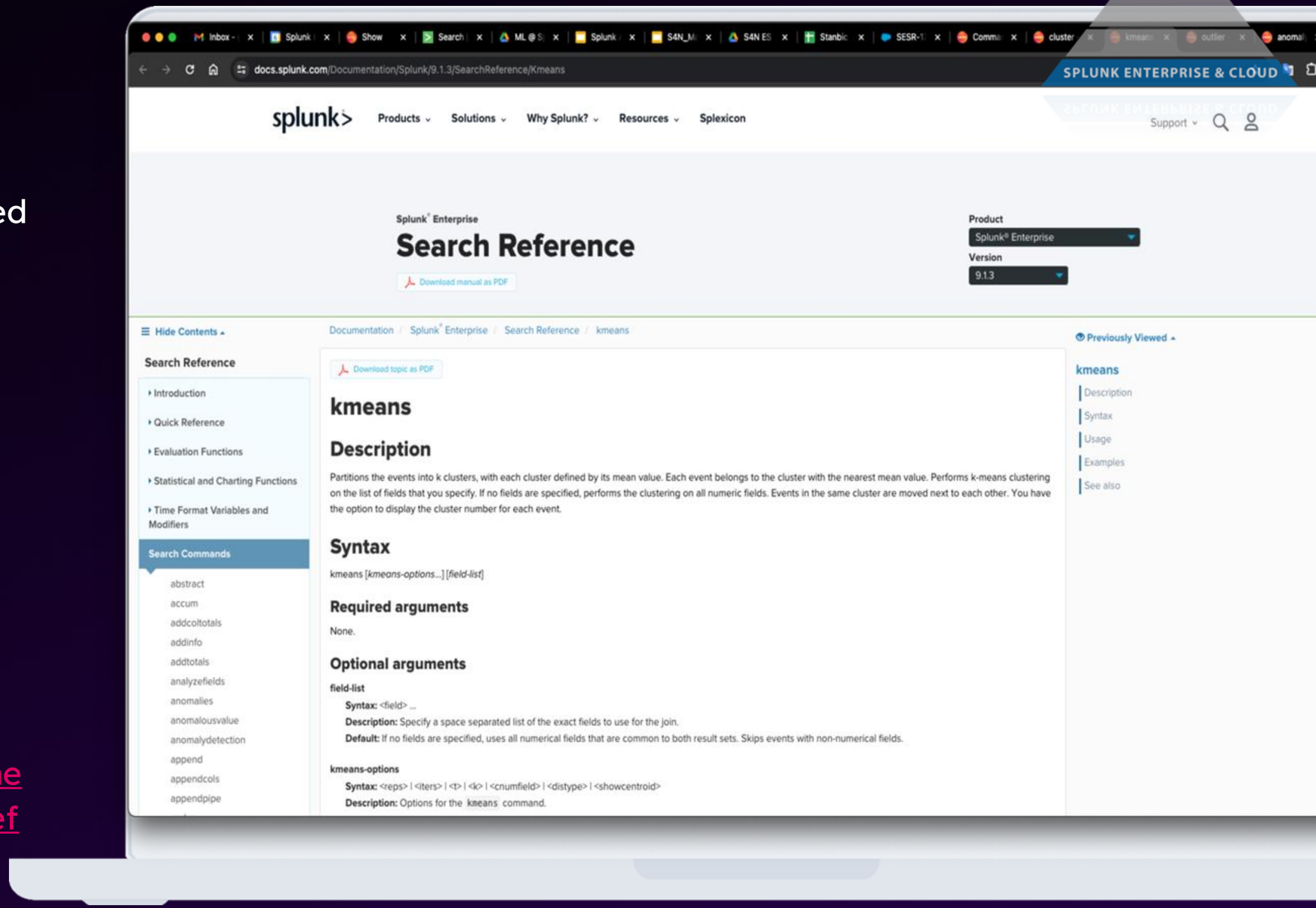
This command is used to remove outliers, not detect them. It removes or truncates outlying numeric values in selected fields.



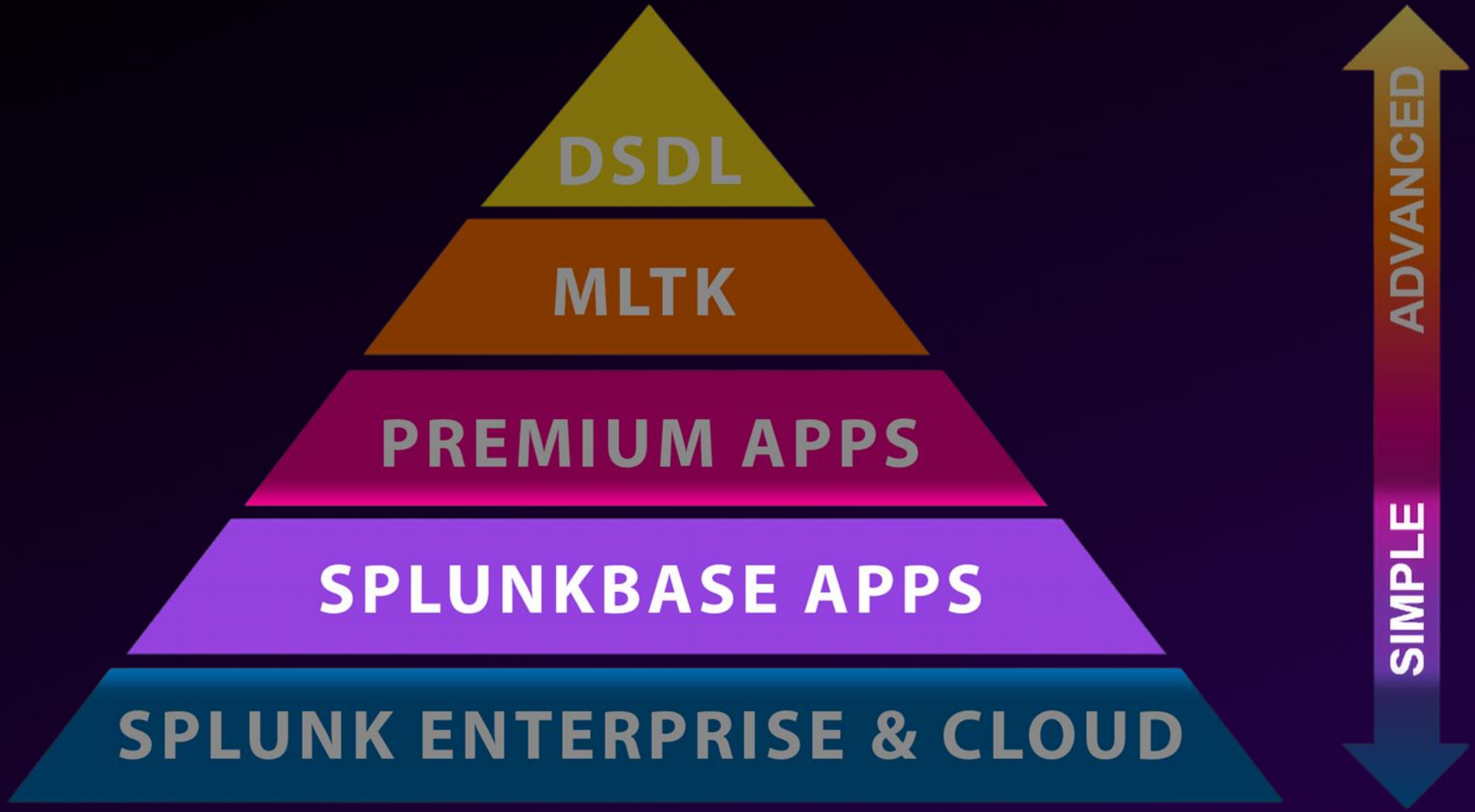
https://docs.splunk.com/Documentation/Splunk/latest/SearchReference/Outlier

|kmeans

Partitions the events into k clusters, with each cluster defined by its mean value.



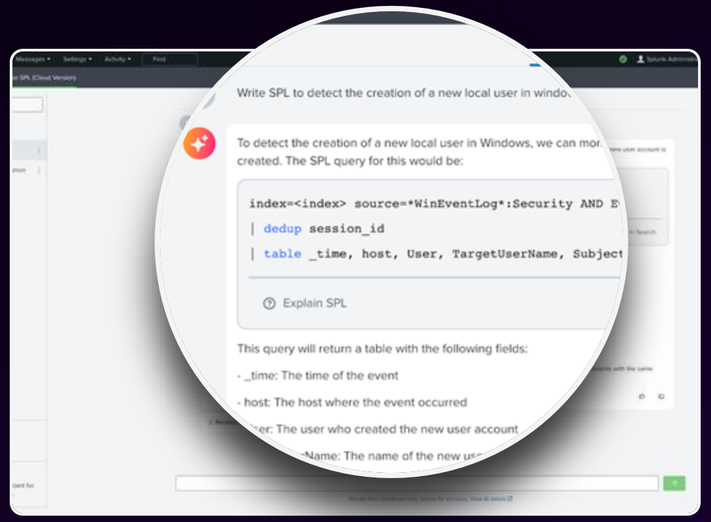
https://docs.splunk.com/Documentation/Splunk/latest/SearchReference/Kmeans



Splunk AI Assistants everywhere

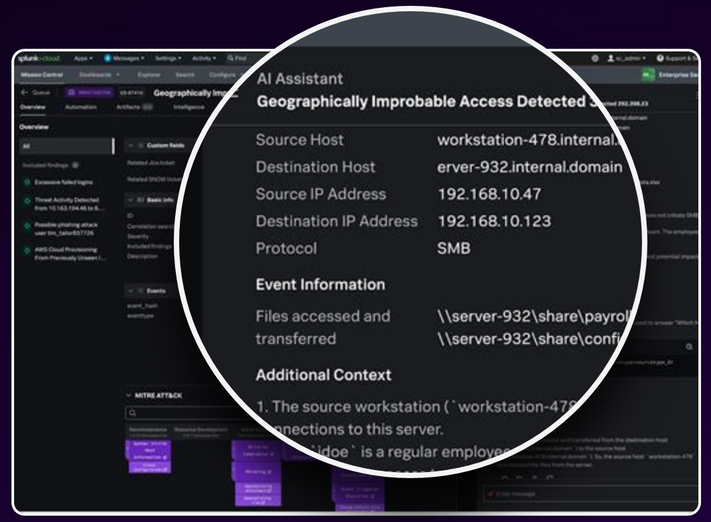
Our goal: Make everyone a Splunk expert!

AI Assistant for SPL



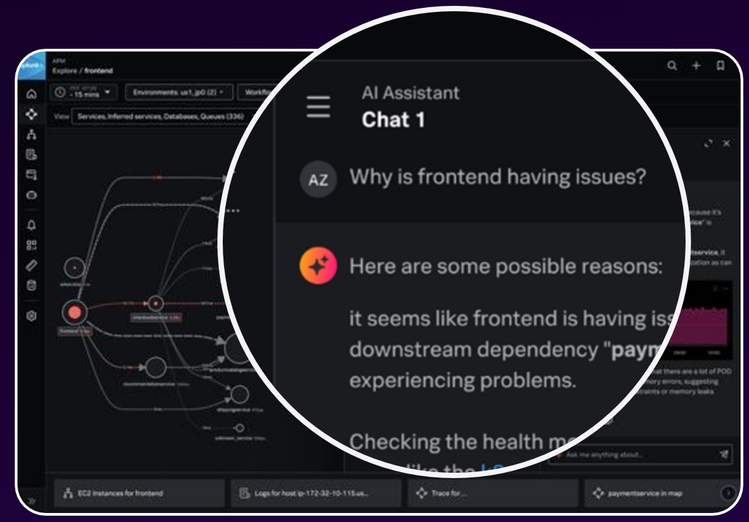
Generally Available

AI Assistant in Enterprise Security

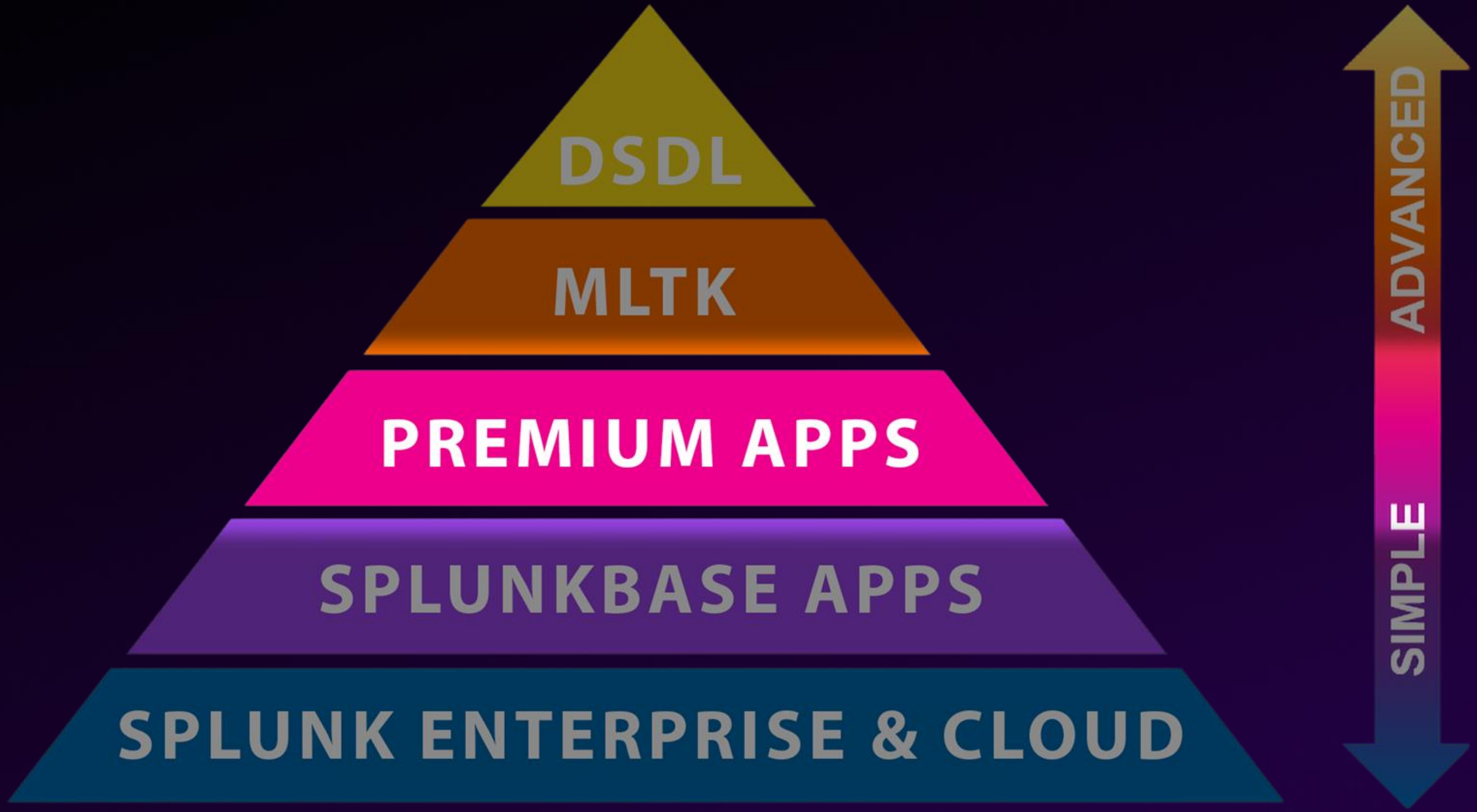


Generally Available

AI Assistant in Observability Cloud



Generally Available



AI for Security

Splunk Enterprise Security

with ML-Powered Content Updates from the Splunk Machine Learning for Security Team

Study Threats

Identify emerging threats and understand how they operate

Create Datasets

Collect data and use Splunk to parse the data and identify patterns that can be used to detect the threat

Build ML-Powered Detections

Build a model based on data in order to make predictions or decisions; enable systems to learn from data, identify patterns, and make decisions with minimal human intervention; and craft rules or queries designed to identify specific activity associated with threats

Test Detections

Run queries against a dataset that simulates attacker behavior to improve accuracy and reduce false positives

Release

Package detections to deliver timely and effective protections against emerging threats to Splunk customers

ESCU
Enterprise Security Content Updates

Security Content

Detections Analytic Stories Playbooks Blog About

machine learning

78 Result(s) found

Splunk Command and Scripting Interpreter Risky SPL MLTK

Try in Splunk Security Cloud Description This detection utilizes machine learning model named "risky_command_abuse" trained from "Splunk Command and Scripting...

Potentially malicious code on commandline

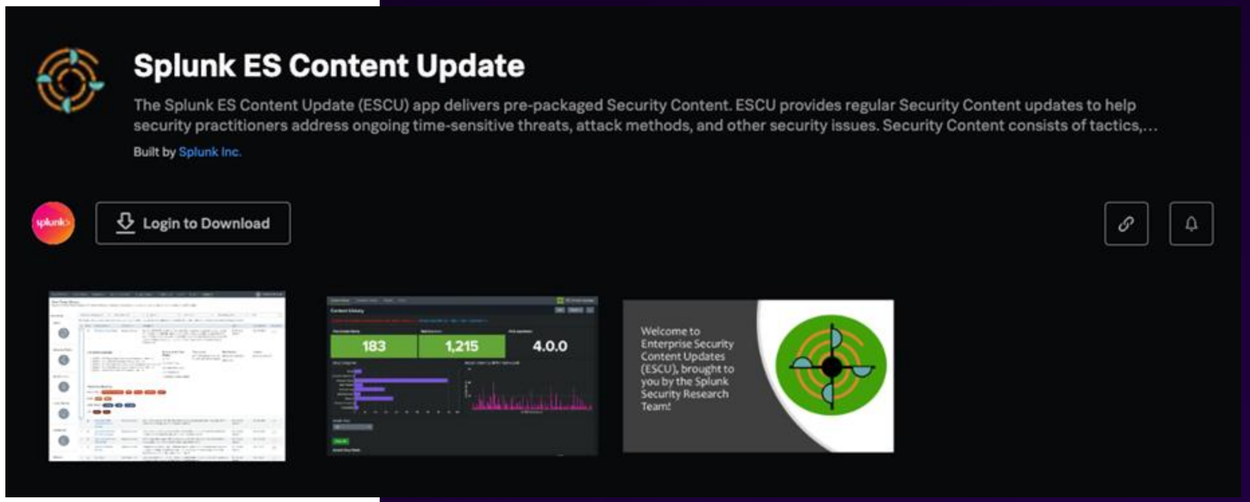
Try in Splunk Security Cloud Description The following analytic uses a pretrained machine learning text classifier to detect potentially malicious...

Azure Active Directory High Risk Sign-in

Try in Splunk Security Cloud Description The following analytic triggers on a high risk sign-in against Azure Active Directory identified...

Modification Of Wallpaper

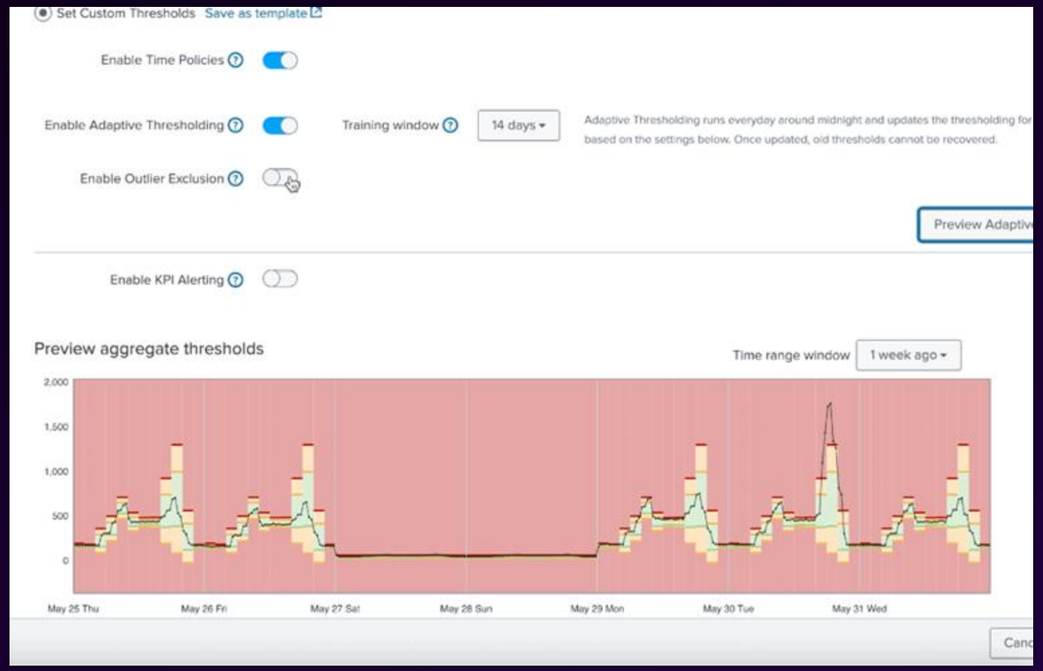
Try in Splunk Security Cloud Description This analytic identifies suspicious modification of registry to deface or change the wallpaper of...



Splunk IT Service Intelligence (ITSI)

Splunk's **AIOps** Solution

Splunk ITSI applies machine learning to **proactively prevent outages** by correlating and reducing alerts, monitoring service health, and streamlining incident management.



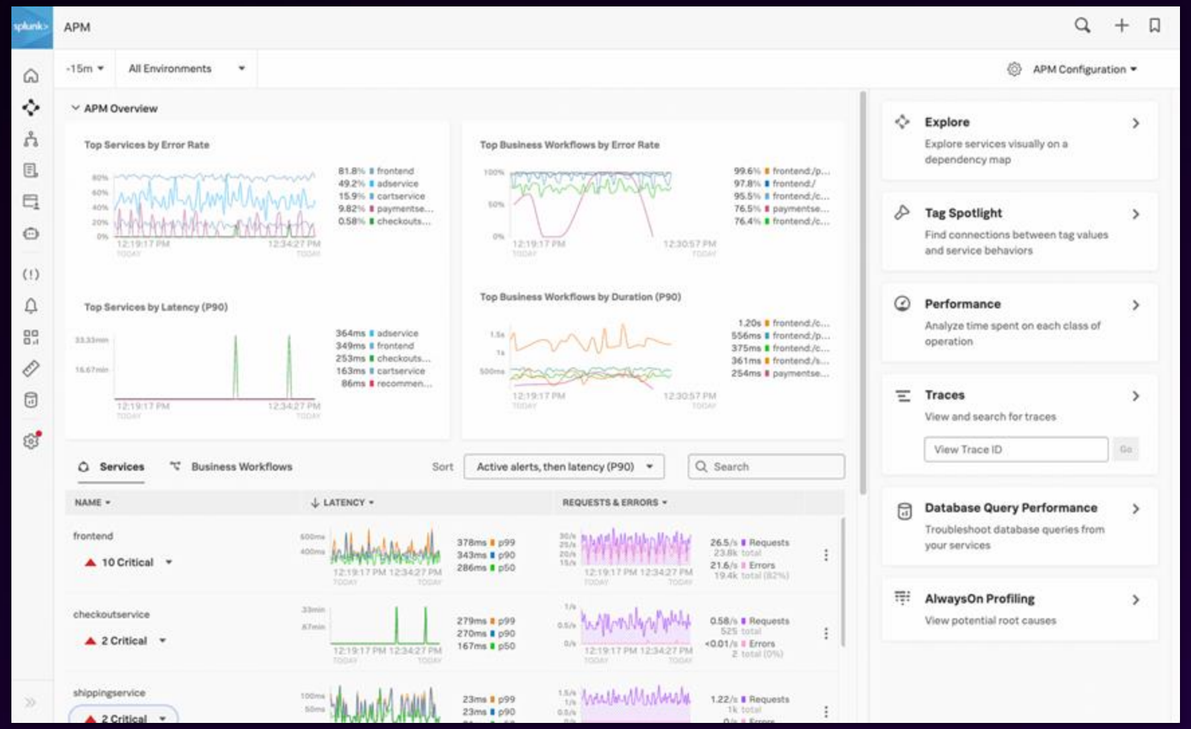
- Clustering & aggregation to reduce alert noise
- Adaptive (dynamic) thresholds incorporate seasonality
- Anomaly and outlier detection
- Actionable additional context
- Assisted root cause investigation
- Predict service health to prevent outages

New updates!

- Outlier Exclusion in Adaptive Thresholds
- ML-Assisted Thresholding *(Preview)*

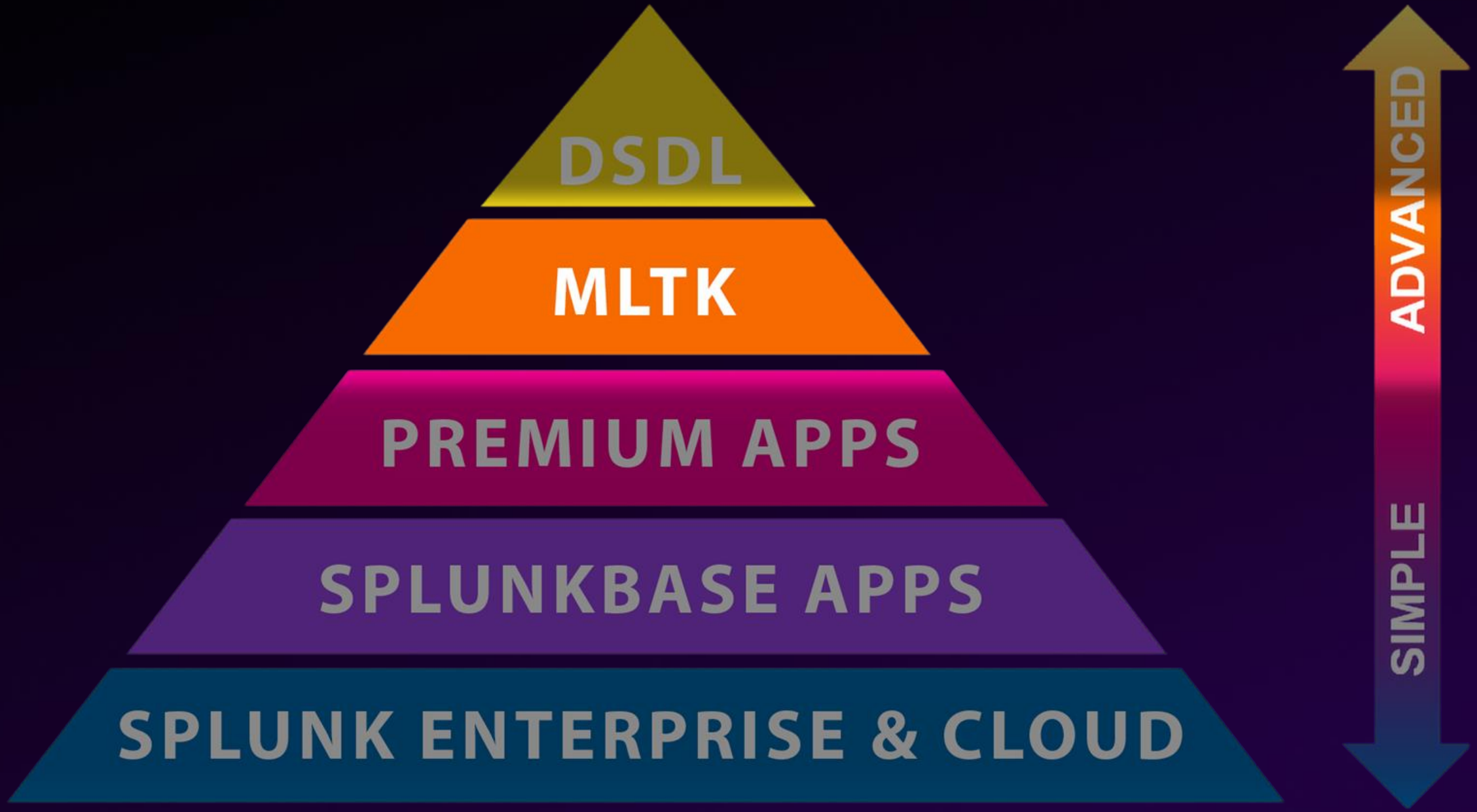
Application and Infrastructure Monitoring: Autodetect

More accurate and efficient alerting for your infrastructure and services



Use machine learning to **improve accuracy** and **reduce manual effort** across infrastructure and service alerting

- Establish performance baselines across every service
- Automate alerting by receiving recommendations for the biggest spikes in latency, errors, and resource utilization
- Easily customize alert thresholds and subscribe to notifications for specific services or teams



Python for Scientific Computing (PSC)

Extend the Splunk Platform Python runtime with AI specific libraries

NetworkX
Network Analysis in Python
python™
PyTorch
ONNX
RUNTIME
scikit
learn
statsmodels
Hugging Face
SciPy
pandas
NumPy

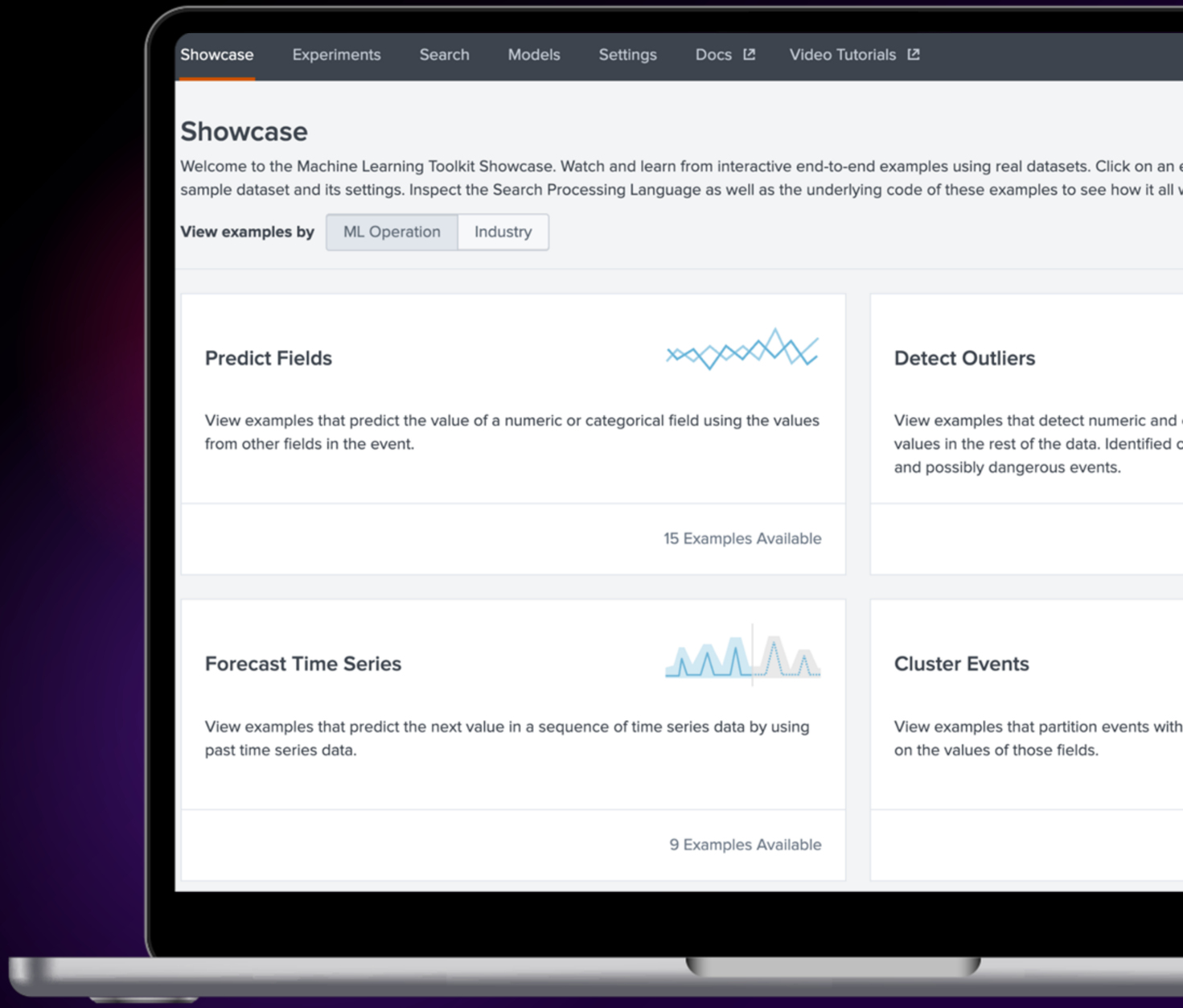
Run complex AI/ML based analytics

in the Splunk Platform, with a broad range of supported Open Source Python libraries

Customize AI with AI Toolkit (AITK)

In Splunk Enterprise and Cloud Platform

- Experiment and model your Splunk data with guided assistant for the whole AI workflow.
- 50+ algorithms to choose from or bring your own model.
- Train and deploy with search commands and operationalize in real-time.

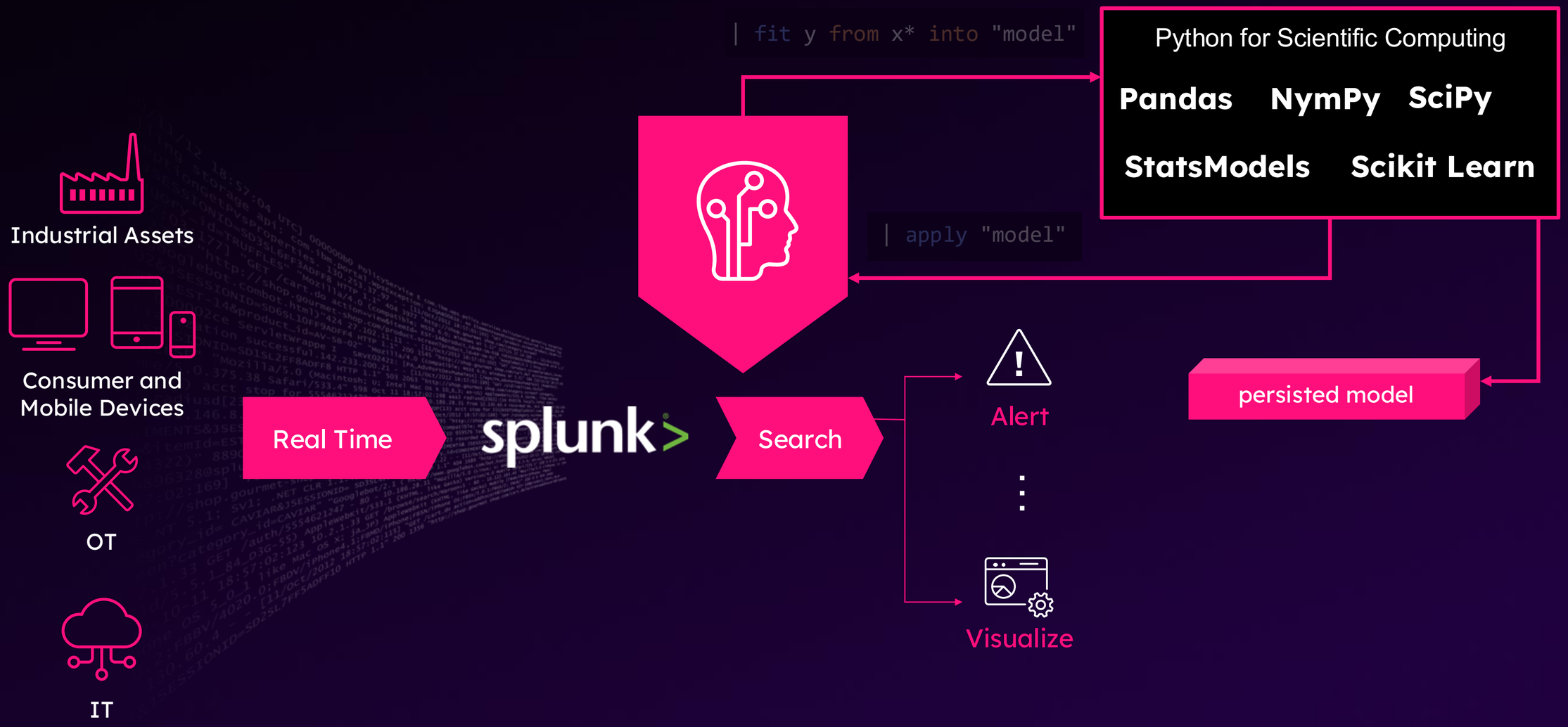


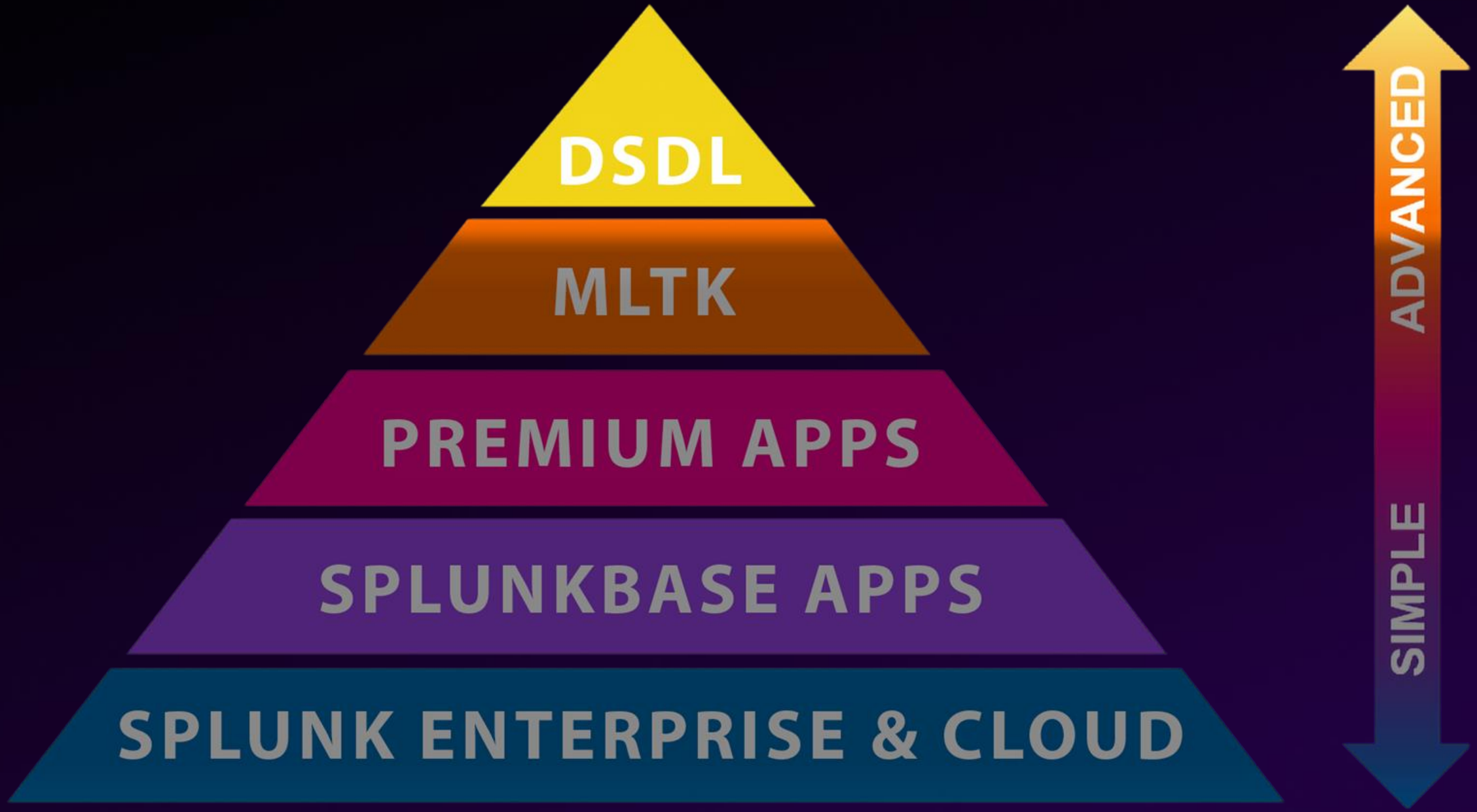
Plot the outliers

```
| inputlookup logins.csv | predict logins as predi(
future_timespan=150 holdback=0 | where prediction!=
eval residual = prediction - logins
```

```
| streamstats window=72 current=true median("logins") as median                    // calculate the median value using a sliding window
| eval absDev=(abs('logins'-median))                                               // calculate the absolute deviation of each value from the median
| streamstats window=72 current=true median(absDev) as medianAbsDev                // use the same sliding window to compute the median absolute deviation
| eval lowerBound=(median-medianAbsDev*exact(9)), upperBound=
(median+medianAbsDev*exact(9))                                                     // calculate the bounds as a multiple of the median absolute deviation
| eval isOutlier=if('logins' < lowerBound OR 'logins' > upperBound, 1, 0)          // mark values outside the bounds as outliers
| fields _time, "logins", lowerBound, upperBound, isOutlier, *                     // format the columns to be in the order expected by the Outliers Plot
                                                                                   visualization
```

Model Longevity

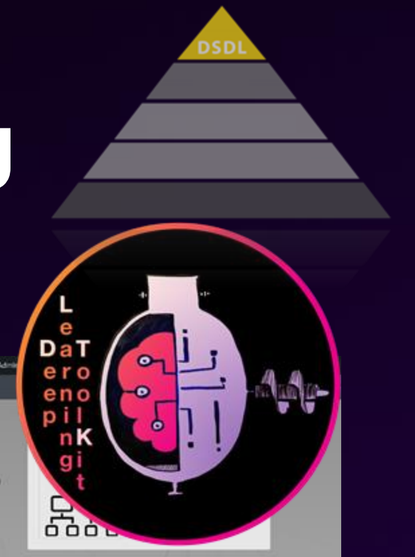




Customizable ML

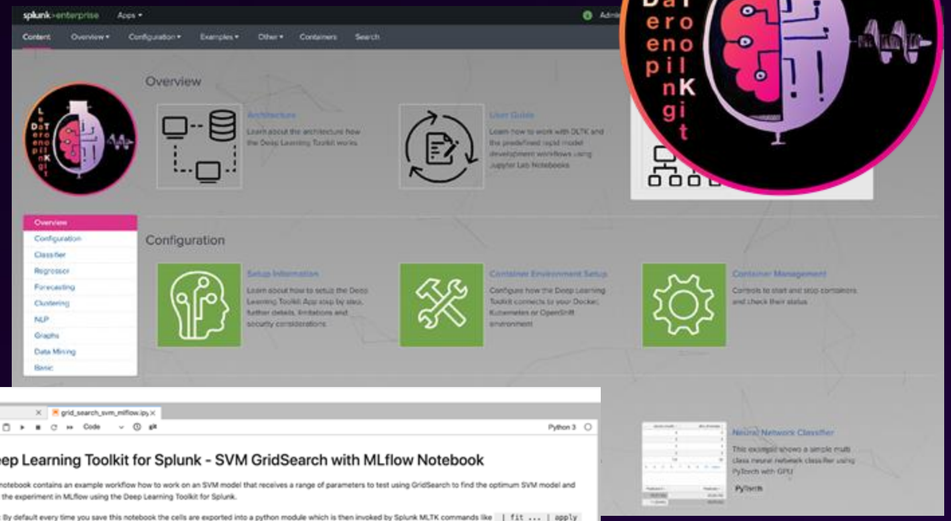
Splunk App for Data Science and Deep Learning

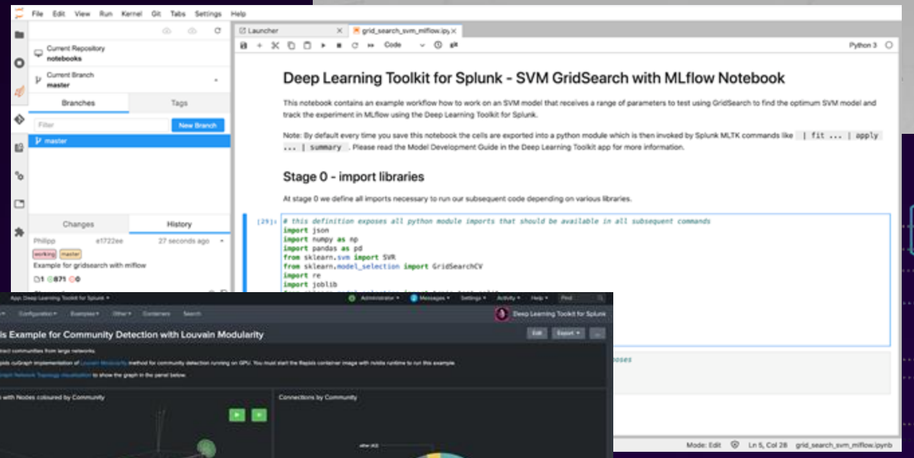
aka. Deep Learning Toolkit for Splunk (DLTK)

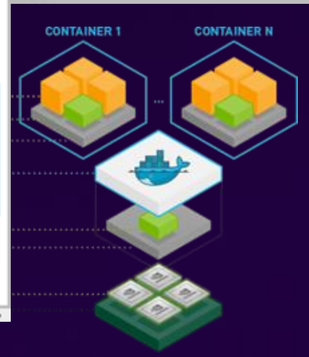


Built for Data Scientists

- **Frameworks:**
  Freely available app for advanced data science projects using any open-source AI frameworks contains PyTorch, Tensorflow 2.0, SpaCey, Jupyter Notebook, & lot more
- **Code Examples:**
  Guided model building, testing, and deployment of deep learning frameworks
- **GPU Support:**
  Speed up your data science projects with GPU accelerated containers
- **K8s Support:**
  Scalable and HA with K8s deployment
- **Open source for customization:**
  https://github.com/splunk/splunk-mltk-container-docke

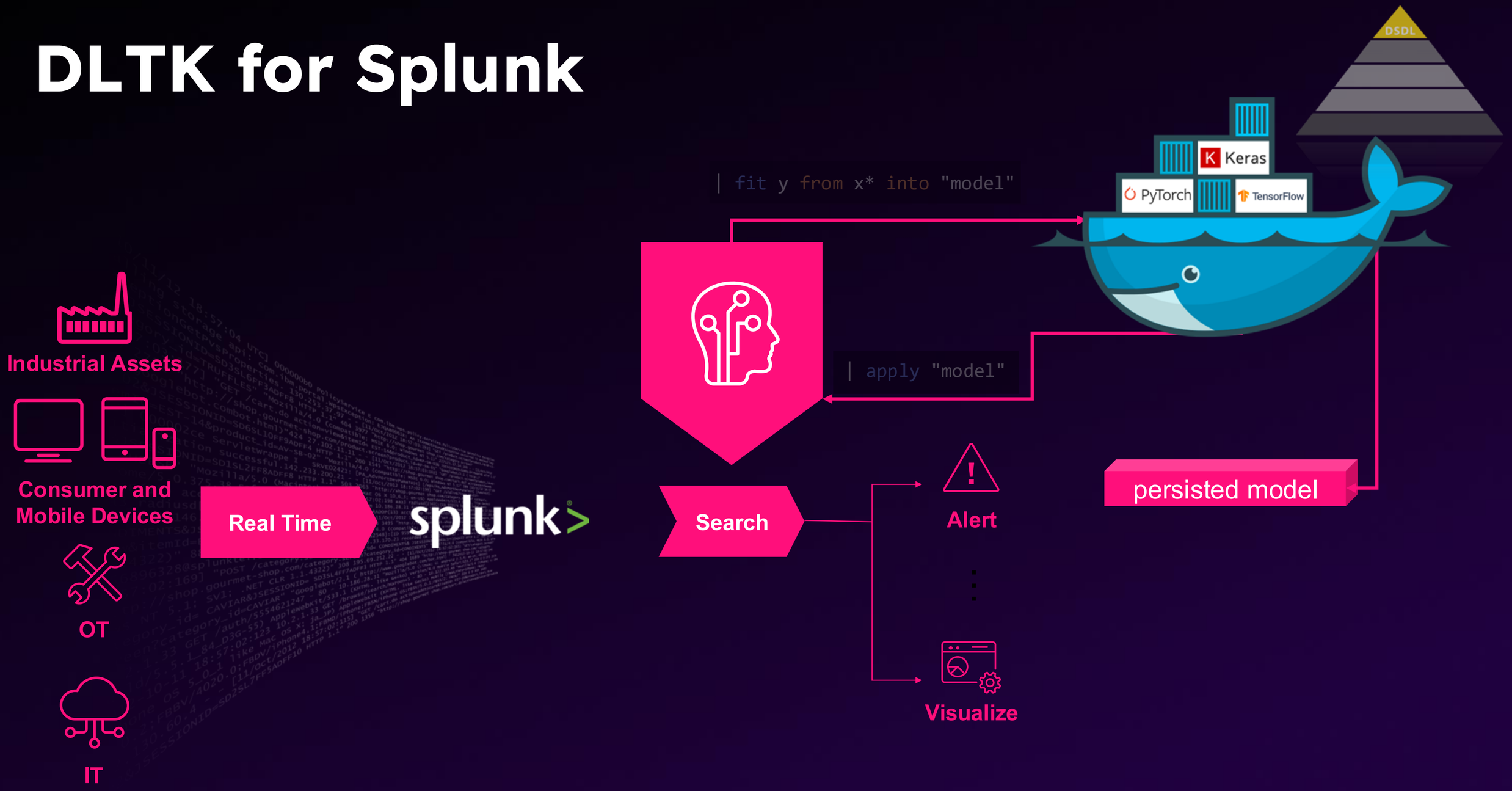






This is now becoming a "must-have" for every citizen data scientists

DLTK for Splunk



REGISTRATION 5 MINS

Enroll in Today's Workshop

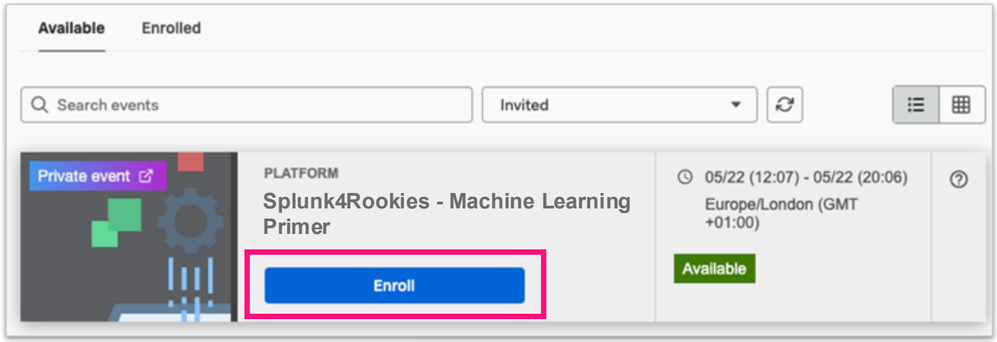
Tasks

1. Get a splunk.com account if you don't have one yet: https://splk.it/SignUp

1. Enroll in the Splunk Show workshop event: https://show.splunk.com/event/<eventID>

2. Download a copy of today's slide deck: https://splk.it/S4RML-Primer-Attendee

Goal



Enroll in today's event

Road to SUCCESS

What steps will help you to make you ML project a success.

Includes:

- Understanding your data
- Cleaning/munging your data
- Operationalizing the data set

Source:Hajicon, flaticon.com

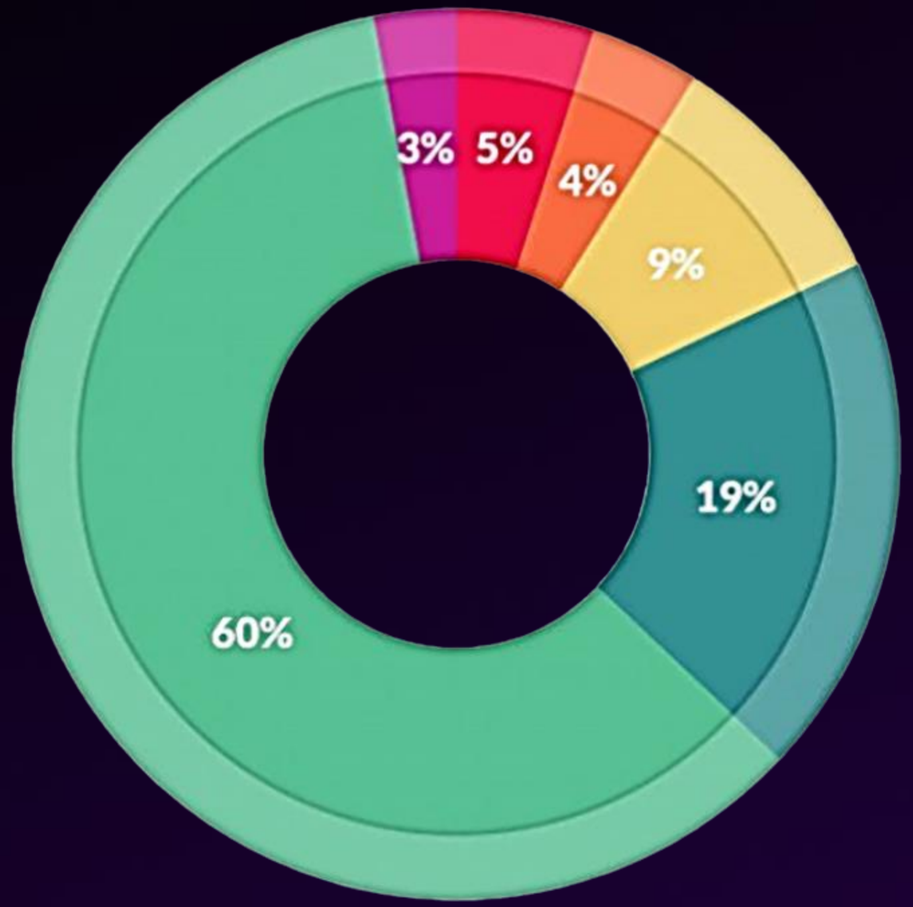
Cleaning Big Data, the Most Time-Consuming, Least Enjoyable Data Science Task

Forbes Survey

March 23

What Data Scientists Really Do

Data Preparation accounts for about 80% of the work of data scientists



Building training sets	3%
Cleaning and organizing data	60%
Collecting data sets	19%
Mining data for patterns	9%
Refining algorithms	4%
Other	5%

“Cleaning Big Data: Most Time-Consuming, Least Enjoyable Data Science Task, Survey Says”, Forbes Mar 23, 2016

Modern AI Stack: The Emerging Building Blocks for GenAI

Layer 4: Observability

OBSERVABILITY, EVALUATION, SECURITY

Helicone · AgentOps · Humanloop · Credal.ai · CALYPSOAI · truera · eppo · BRAINTRUST · Patronus AI · splunk>

Layer 3: Deployment

PROMPT MANAGEMENT

vellum · LangSmith

ORCHESTRATION

Martian · orkes · Radiant

AGENT TOOL FRAMEWORKS

LangChain · Auto gpt · FIXIE · LlamaIndex

Layer 2: Data

DATA PRE-PROCESSING

gable · datologyai · Cleanlab

ETL + DATA PIPELINES

UNSTRUCTURED · NOMIC · Lexy · Indexify

DATABASES (VECTOR, DB, METADATA STORE, CONTEXT CACHE)

databricks · upstash · Pinecone · NEON · WarpStream · momento

Layer 1: Compute + Foundation

MODEL DEPLOYMENT + INFERENCE

baseten · Modal · Replicate · clarifai · Substrate · fireworks.ai

FINETUNING + RLHF

LAMINI · Predibase · arcee.ai

FOUNDATION MODELS

OpenAI · ANTHROPIC · MISTRAL AI_ · contextual·ai · Hugging Face · Llama 2

TRAINING

Modular · Lightning AI · OctoML

GPU PROVIDERS

aws · Azure · Google Cloud · CoreWeave · Lambda · FOUNDRY · together.ai

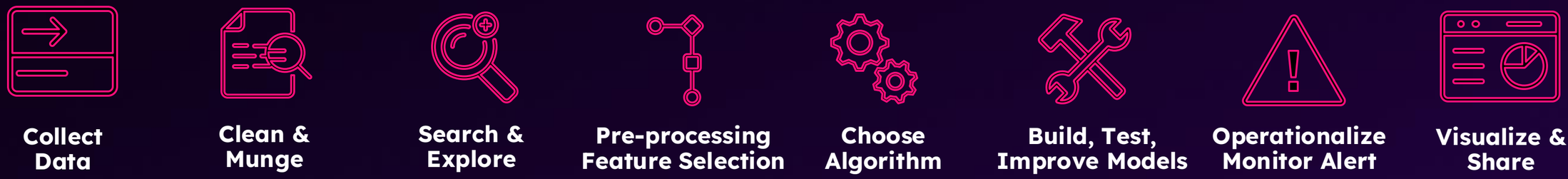
Custom ML with the Splunk Platform

Ecosystem — Splunk's App Ecosystem contains 1000's of free add-ons for getting data in, applying structure and visualizing your data giving you faster time to value.

MLTK — The Machine Learning Toolkit delivers new SPL commands, custom visualizations, assistants, and examples to explore a variety of ml concepts.

Splunk — Splunk Enterprise is the mission-critical platform for indexing, searching, analyzing, alerting and visualizing machine data.

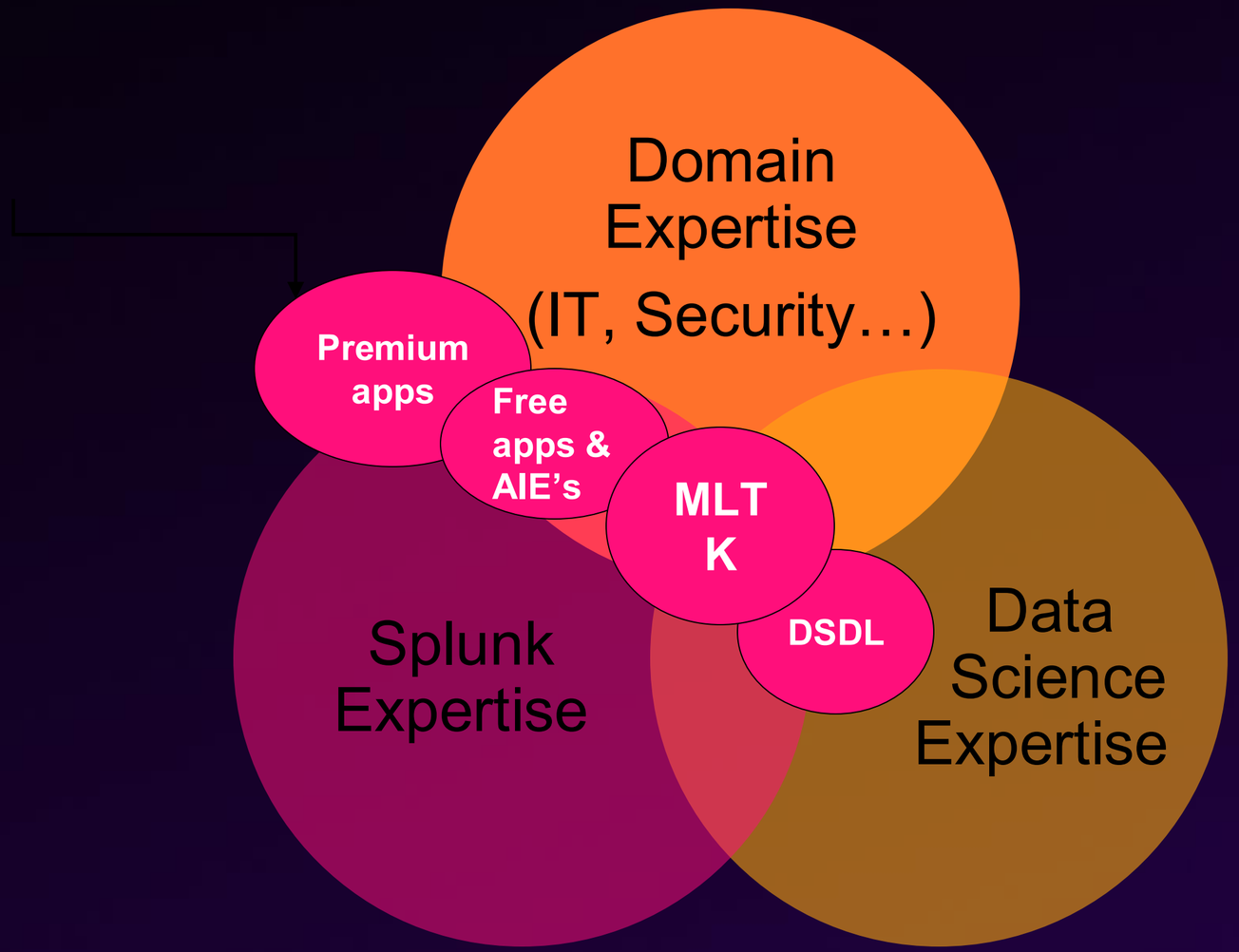
Operationalized Data Science Pipeline



Collect Data	Clean & Munge	Search & Explore	Pre-processing Feature Selection	Choose Algorithm	Build, Test, Improve Models	Operationalize Monitor Alert	Visualize & Share
Ecosystem	Ecosystem	Ecosystem	MLTK	MLTK	MLTK	MLTK	Ecosystem
Splunk	Splunk	Splunk	Splunk	Splunk	Splunk	Splunk	Splunk

splunk> Platform for Operational Intelligence

Splunk can help at every skill level



Numeric

Categorical

Data understanding

Is it good data?

Machine data is complex but to get answers of your data, it is important to understand your data.

A clean and usable data set does not have:

- **Missing data**
- **Noisy data**
- **Bias**
- **Duplicate data**
- **outliers**

If your data set does not contain any of this you can start applying ML.

Otherwise, it’s time to gather and clean!

Missing Data

Missing data in a dataset can lead to:

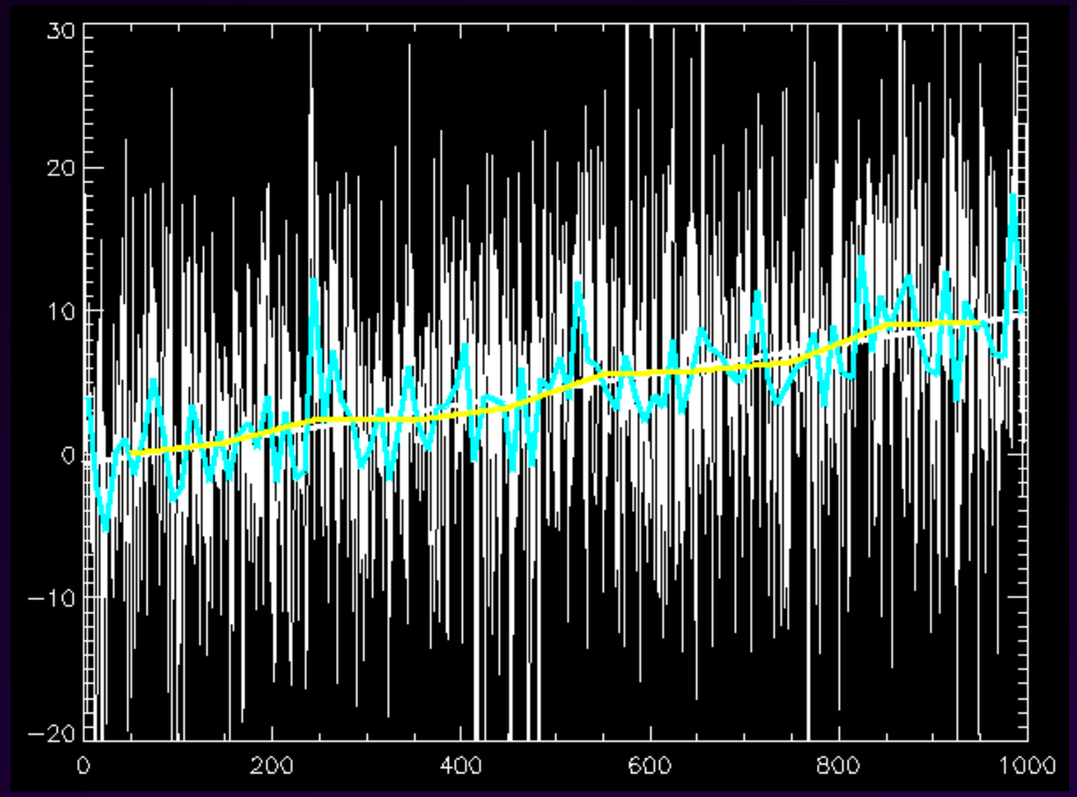
- Reduced model performance
- Corrupted relationships
- Loss of information
- Bias in models

	School ID	Name	Address	City	Subject	Marks	Rank	Grade
0	101.0	Alice	123 Main St	Los Angeles	Math	85.0	2	B
1	102.0	Bob	456 Oak Ave	New York	English	92.0	1	A
2	103.0	Charlie	789 Pine Ln	Houston	Science	78.0	4	C
3	NaN	David	101 Elm St	Los Angeles	Math	89.0	3	B
4	105.0	Eva	NaN	Miami	History	NaN	8	D
5	106.0	Frank	222 Maple Rd	NaN	Math	95.0	1	A
6	107.0	Grace	444 Cedar Blvd	Houston	Science	80.0	5	C
7	108.0	Henry	555 Birch Dr	New York	English	88.0	3	B

ML can not answer questions on which it does not have data

Noisy Data

Noisy data consists of incorrect, irrelevant, or random variations in the dataset that obscure meaningful patterns and degrade model performance.

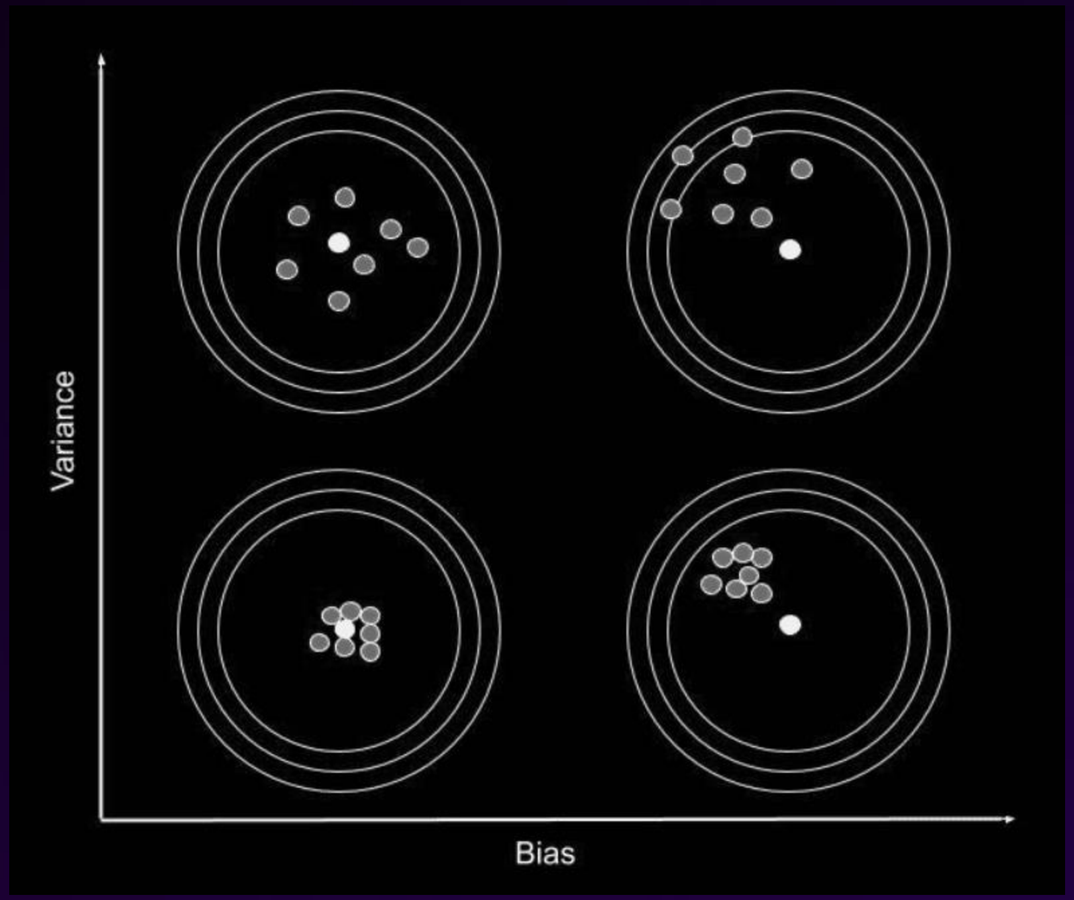


Noisy data in a dataset can lead to:

- Confused Model Training
- Reduced Model Accuracy
- Increased Overfitting Risk

Bias

Bias in machine learning refers to systematic errors or assumptions in a model that lead to unfair or inaccurate outcomes by favoring certain patterns, groups, or perspectives over others.



Duplicate Data

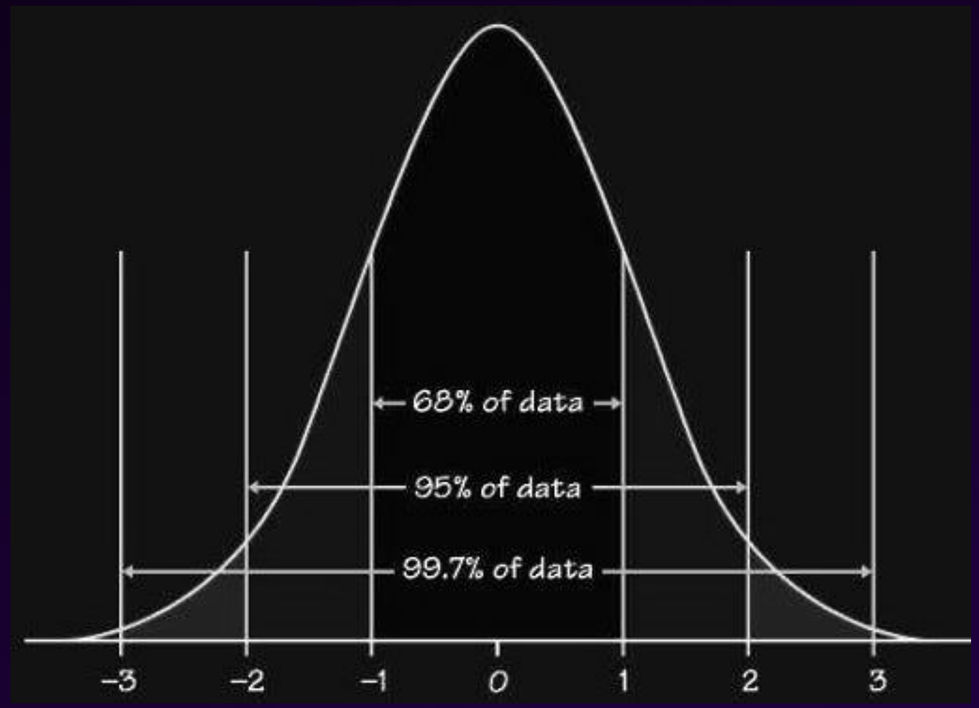
Duplicate entries in a dataset can lead to:

- Distorted Model Training
- Biased Results
- Reduced Model Generalization
- Inefficient Use of Resources

	ln	dob	gn	fn	is_duplicate
0	SMITH JR	01/03/68	F	WILLIAM	0
1	ROTHMEYER JR	01/03/68	F	WILLIAM	0
2	ASBY JR	01/03/68	F	WILLIAM	0
3	SALTER JR	01/03/68	F	WILLIAM	0
4	SALTER JR	01/03/68	F	WILLIAM	1

Outliers

Outliers are data points that significantly differ from the majority of the dataset, often representing extreme values or errors that can distort analysis and model performance.



Outliers can lead to:

- Skewed Model Training
- Distorted Metrics
- Reduced Model Generalization
- Increased Preprocessing Efforts

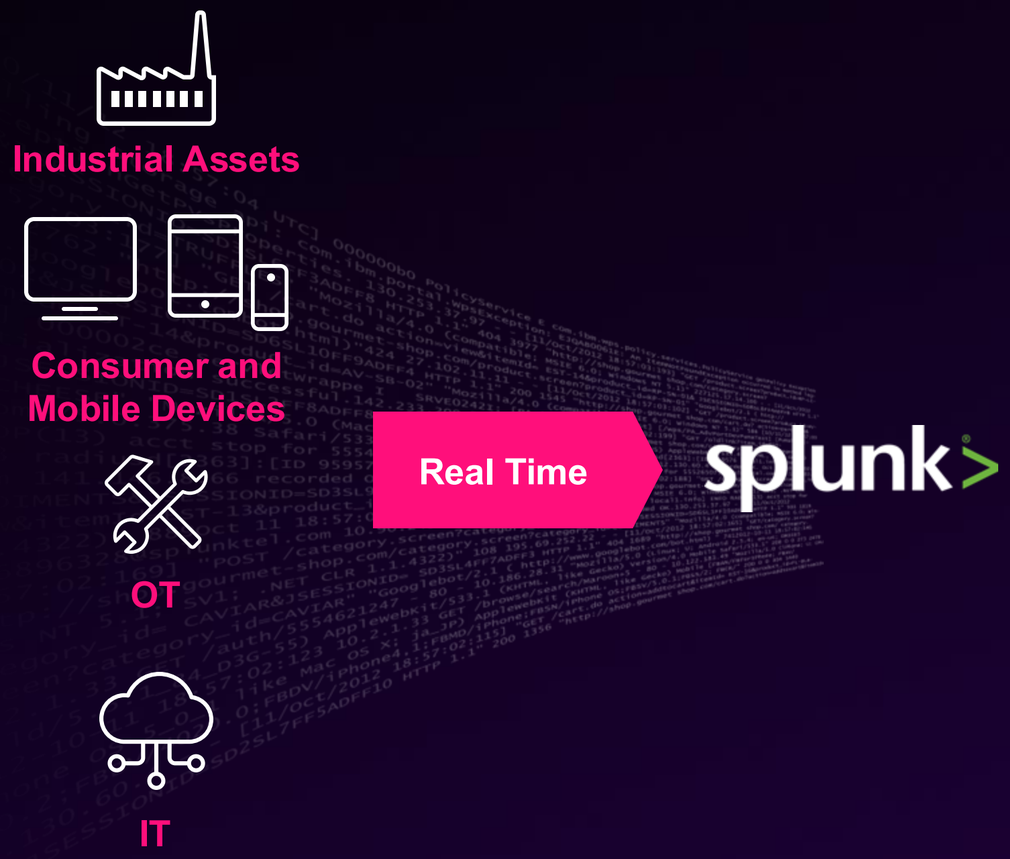
Data Collection

Gain access to previously unused data

- Infrastructure data
- Application usage and access data
- GenAI prompt and output data
- Help desk and ticketing system data
- IoT and OT data

At Scale

Store, retain, and search data at unprecedented scale



Scalable index and storage

Flexible offering models

Federated analytics

Data understanding

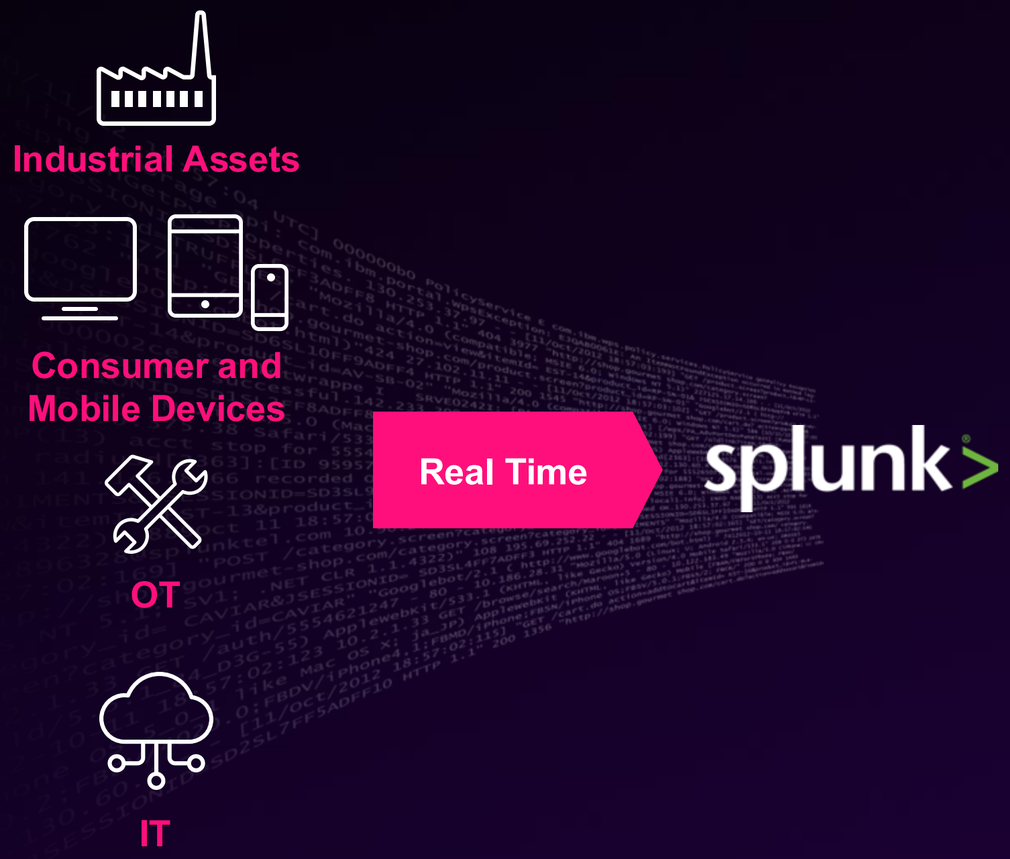
Gain insights to previously unused data

Machine data is messy and complex…

```
10.2.1.35 64.66.0.20 - - [17/Jan/2024
16:21:51] "GET
/product.screen?product_id=CC-P3-BELKIN-
SILBLKIPH5&JSESSIONID=SD5SL6FF1ADFF9 HTTP
1.1" 503 865
"http://shop.splunktel.com/product.screen?pr
oduct_id=CC-P3-BELKIN-BLK_BTOOTH_HFREE"
"Mozilla/5.0 (Linux; Android 12.0.0; FR-fr;
SM-S901B Build/S908EXXU2BVJA)
AppleWebKit/537.36 Chrome/114.0.5735.131
Mobile Safari/537.36" 954
```

Data understanding

Gain insights to previously unused data



Machine data is ~~messy and complex~~ valuable!

```
10.2.1.35 64.66.0.20 - - [17/Jan/2024
16:21:51] "GET
/product.screen?product_id=CC-P3-BELKIN-
SILBLKIPH5&JSESSIONID=SD5SL6FF1ADFF9 HTTP
1.1" 503 865
"http://shop.splunktel.com/product.screen?pr
oduct_id=CC-P3-BELKIN-BLK_BTOOTH_HFREE"
"Mozilla/5.0 (Linux; Android 12.0.0; FR-fr;
SM-S901B Build/S908EXXU2BVJA)
AppleWebKit/537.36 Chrome/114.0.5735.131
Mobile Safari/537.36" 954
```

Data understanding

Gain insights to previously unused data

Machine data i… ~~and complex~~ valuable!

User IP

Product Viewed

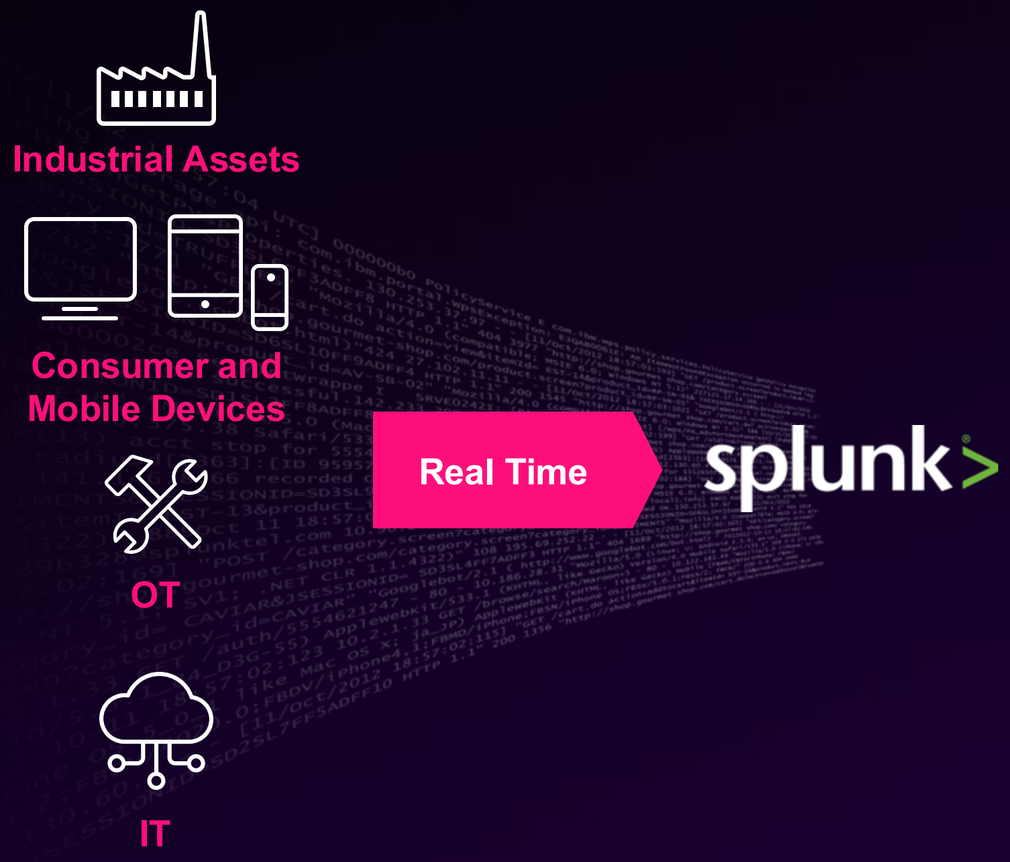
Preferred Language

Device

```
10.2.1.35 64.66.0.20 - - [17/Jan/2024
16:21:51] "GET
/product.screen?product_id=CC-P3-BELKIN-
SILBLKIPH5&JSESSIONID=SD5SL6FF1ADFF9 HTTP
1.1" 503 865
"http://shop.splunktel.com/product.screen?pr
oduct_id=CC-P3-BELKIN-BLK_BTOOTH_HF
"Mozilla/5.0 (Linux; Android 12.0.0; FR-fr;
SM-S901B Build/S908EXXU
AppleWebKit/537.36 Chrome/114.0.5735.131
Mobile Safari/537.36" 954
```

Data understanding

Is it good data?



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- **Duplicate data**
- **outliers**

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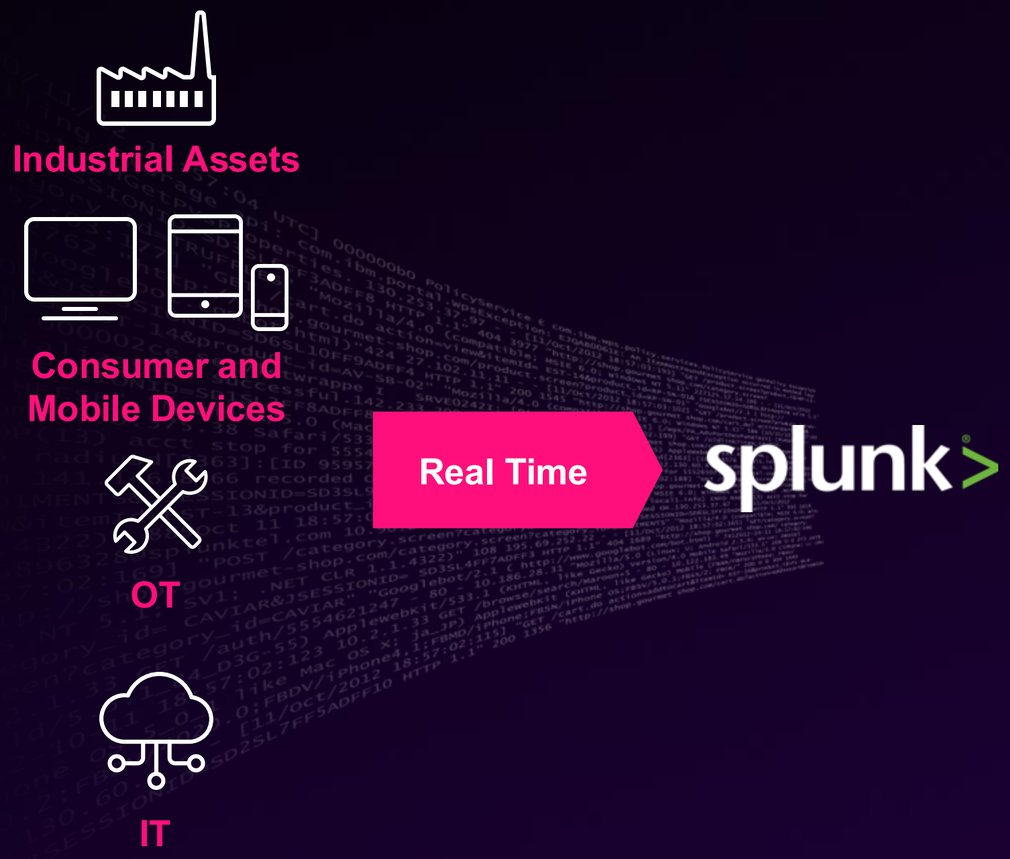
Data Access

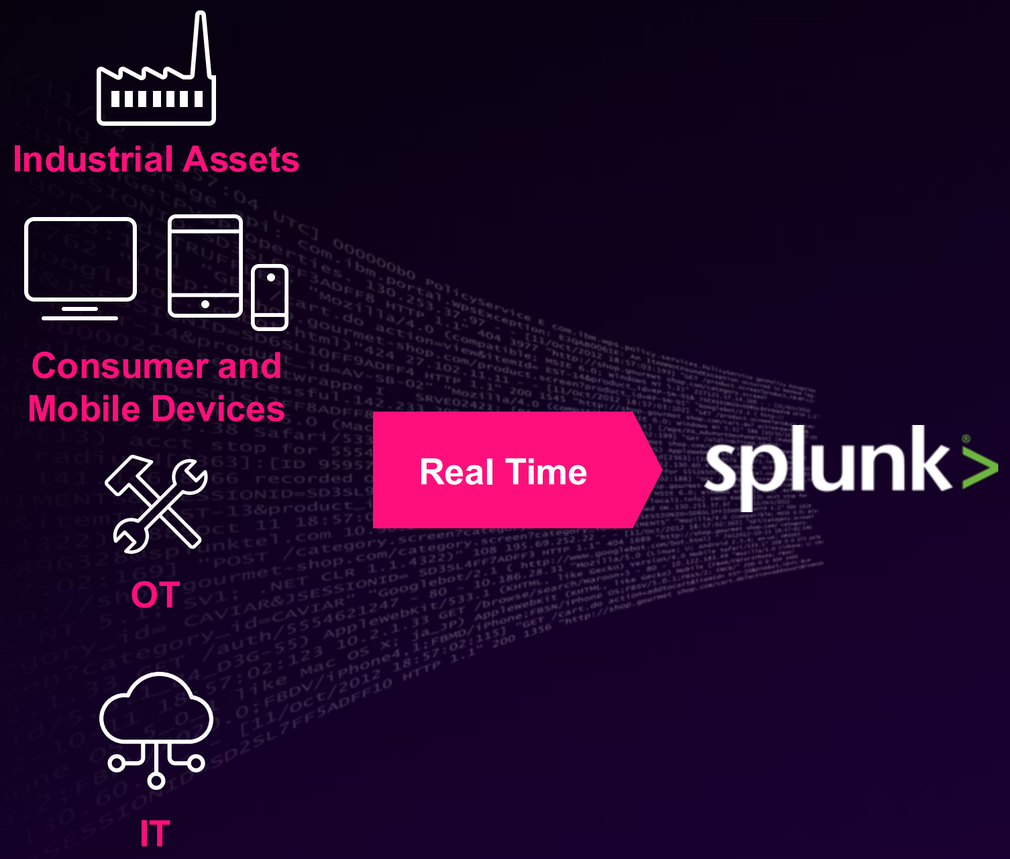
Gain access to previously unused data

```
index="oidemo" sourcetype="access_combined"
```



Data Preparation

Filter data with SPL



Filter

```
index="oidemo" sourcetype="access_combined" action=purchase
```

action

5 Values, 44.612% of events — Selected: Yes / No

Reports

Top values | Top values by time | Rare values | Events with this field

Values	Count	%
purchase	2,243	20.709%
addtocart	2,172	20.054%
view	2,168	20.017%
remove	2,161	19.952%
changequantity	2,087	19.269%

action

1 Value, 100% of events — Selected: Yes / No

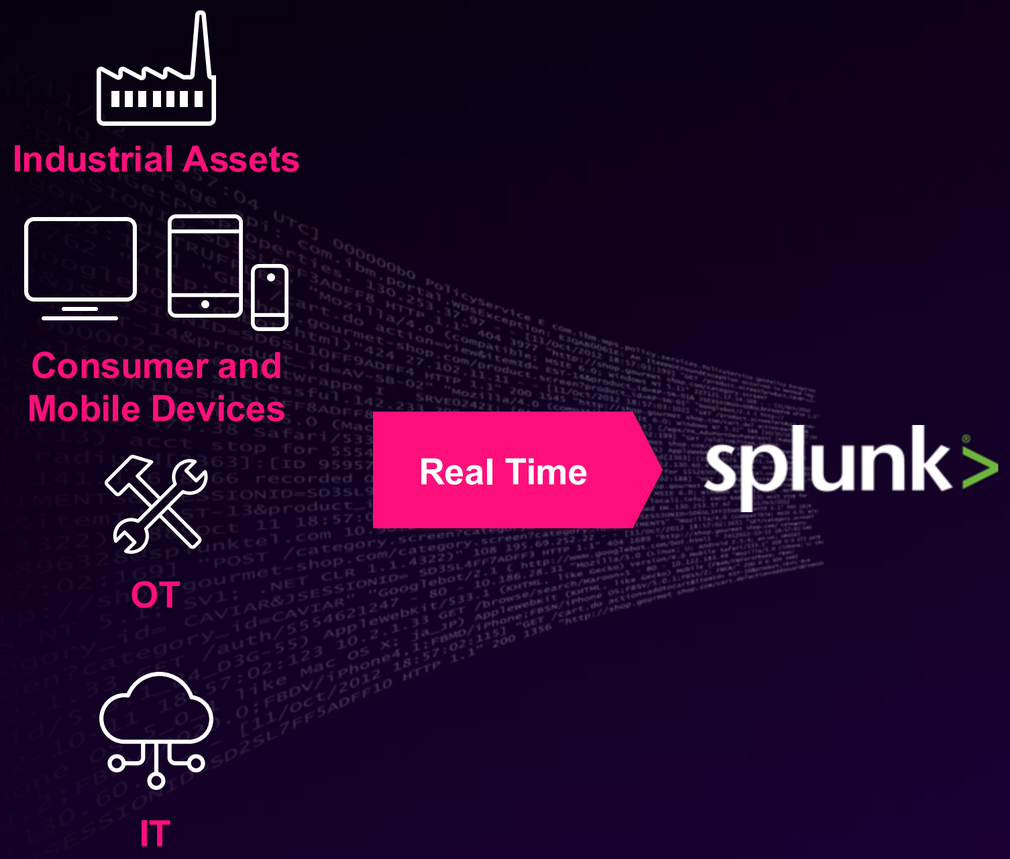
Reports

Top values | Top values by time | Rare values | Events with this field

Values	Count	%
purchase	2,249	100%

Data Preparation

Transform data with SPL



SPLUNK ENTERPRISE & CLOUD

Filter

Transform

```
inde                    ourcetype="access_combined" action=purchase
| iplocation clientip
```

clientip	Country	City
0.134.99.193		
0.134.99.193		
0.134.99.193		
0.152.133.194		
0.152.133.194		
0.152.133.194		
1.12.191.128		
1.16.209.124		

clientip	Country	City
0.134.99.193		
0.134.99.193		
0.134.99.193		
0.152.133.194		
0.152.133.194		
0.152.133.194		
1.12.191.128	China	Haidian (Haidian Qu)
1.16.209.124	Australia	South Brisbane
1.16.209.124	Australia	South Brisbane

Data Preparation

Clean data with SPL

SPLUNK ENTERPRISE & CLOUD

Filter

Transform

Clean

```
inde                    ourcetype="access_combined" action=purchase
| iplocation clientip
| fillnull value="Unknown" Country
```

clientip	Country	City
0.134.99.193		
0.134.99.193		
0.134.99.193		
0.152.133.194		
0.152.133.194		
0.152.133.194		
1.12.191.128	China	Haidian (Haidian Qu)
1.16.209.124	Australia	South Brisbane
1.16.209.124	Australia	South Brisbane

clientip	Country	City
0.134.99.193	unknown	unknown
0.134.99.193	unknown	unknown
0.134.99.193	unknown	unknown
0.152.133.194	unknown	unknown
0.152.133.194	unknown	unknown
0.152.133.194	unknown	unknown
1.12.191.128	China	Haidian (Haidian Qu)
1.16.209.124	Australia	South Brisbane

Data Preparation

Aggregate data with SPL

Filter

Transform

```
inde                ourcetype="access_combined" action=purchase
| iplocation clientip
| fillnull value="Unknown" Country
| stats count by product device Country
```

Clean

Aggregate

product	device	Country	count
Bubble_Wrap	iPhone	United States	11
Man_Candle-Bacon	iPhone	United States	10
Canned_Unicorn_Meat	Windows	United States	9

Training ML model

Fit model

Industrial Assets

Consumer and Mobile Devices

OT

IT

Real Time

splunk>

Filter

Transform

Clean

```
inde ourcetype="access_combined" action=purchase
| iplocation clientip
| fillnull value="Unknown" Country
| stats count by product device Country
```

Aggregate

```
| fit algorithm from clientip into "model"
```

Train "model"

Productionalize ML model

Apply model

Industrial Assets

Consumer and Mobile Devices

OT

IT

Real Time

splunk>

Filter

Transform

Clean

```
inde                ourcetype="access_combined" action=purchase
| iplocation clientip
| fillnull value="Unknown" Country
| stats count by product device Country
```

Aggregate

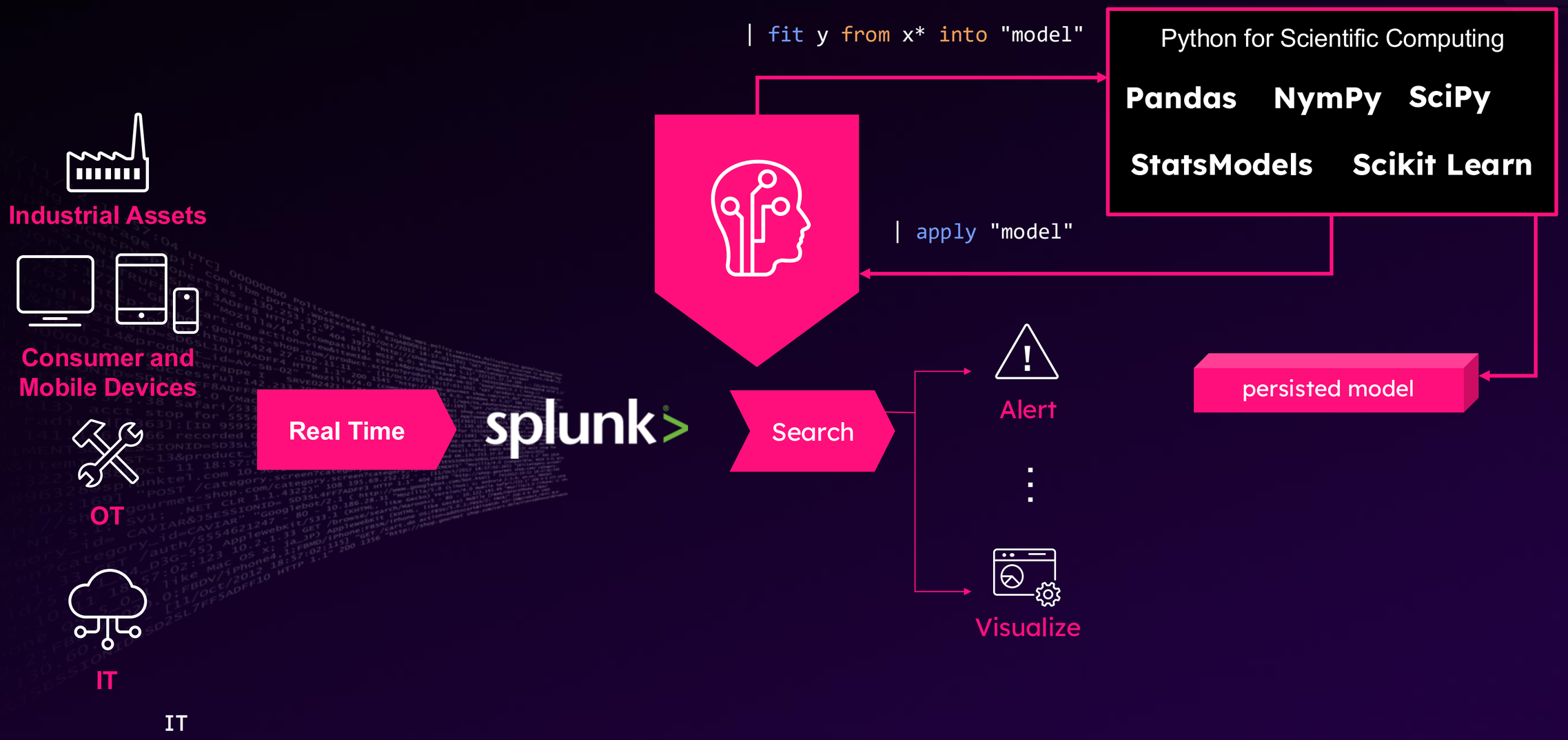
```
| fit algorithm from clientip into "model"
```

Train "model"

```
| apply "model"
```

Run "model"

Model training and application



Hands-on

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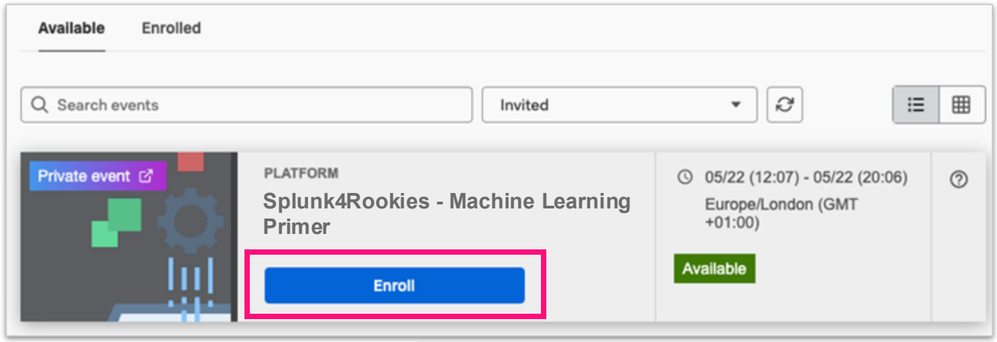
Goal



Enroll in today's event

Use Case:

Find Anomalies in Supermarket Purchases

Outlier Detection Algorithms

Identify and analyze abnormal behavior in your data

Includes:

- Clustering
- Outlier Detection

Source:Hajicon, flaticon.com

Global

Data points different from expected pattern, range, or norm

Contextual

Are the results out of context?

Collective

Looks normal with isolation but stands out in a group

Numeric

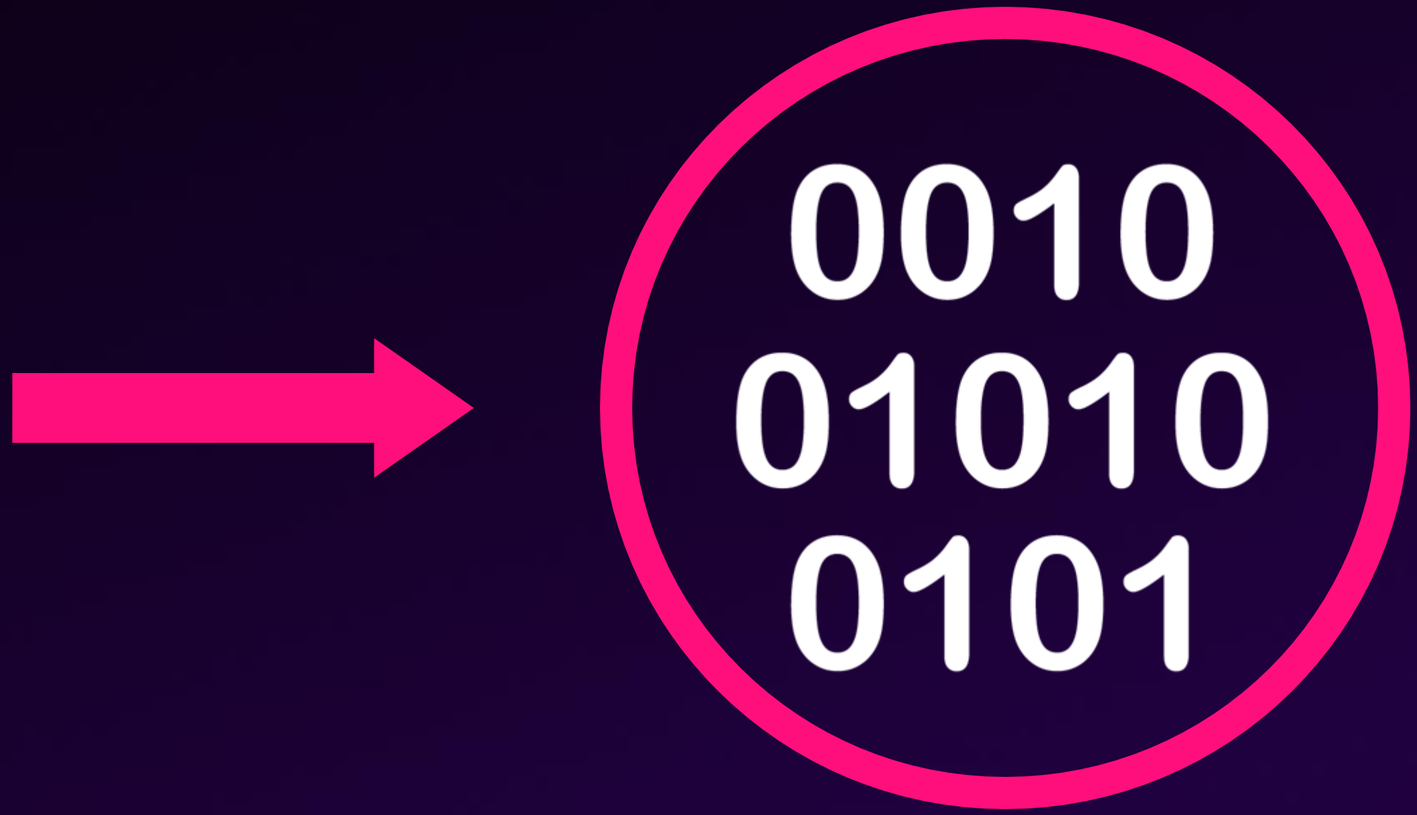
Categorical

Included Algorithms

DensityFunction | LocalOutlierFactor | MultiVariateOutlierDetection | One-Class SVM

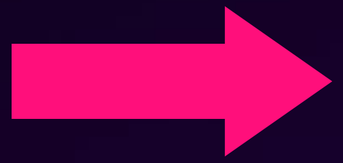
Categorical data to Numeric data?

device
server01
server02
server03



Categorical data to Numeric data?

device
server01
server02
server03



device	server01	server02	server03
server01	1	0	0
server02	0	1	0
server03	0	0	1

Outlier Detection Algorithms

Identify and analyze abnormal behavior in your data

Includes:

- Clustering
- Outlier Detection

Source:Hajicon, flaticon.com

Live Instance Demo

Log Into [INSTANCE URL]

Exercise #1

Time: 10 minutes

Summary

Top 4 most important things to remember about outlier detection

1

Outlier detection is a way of analyzing your data for **historical baseline outliers**

2

Models **assume historic data input represents normal data**

3

Encoding is necessary for categorical outlier detection

4

Choice of outlier algorithm may rely on a **subject matter expert** of the data

Use Case:

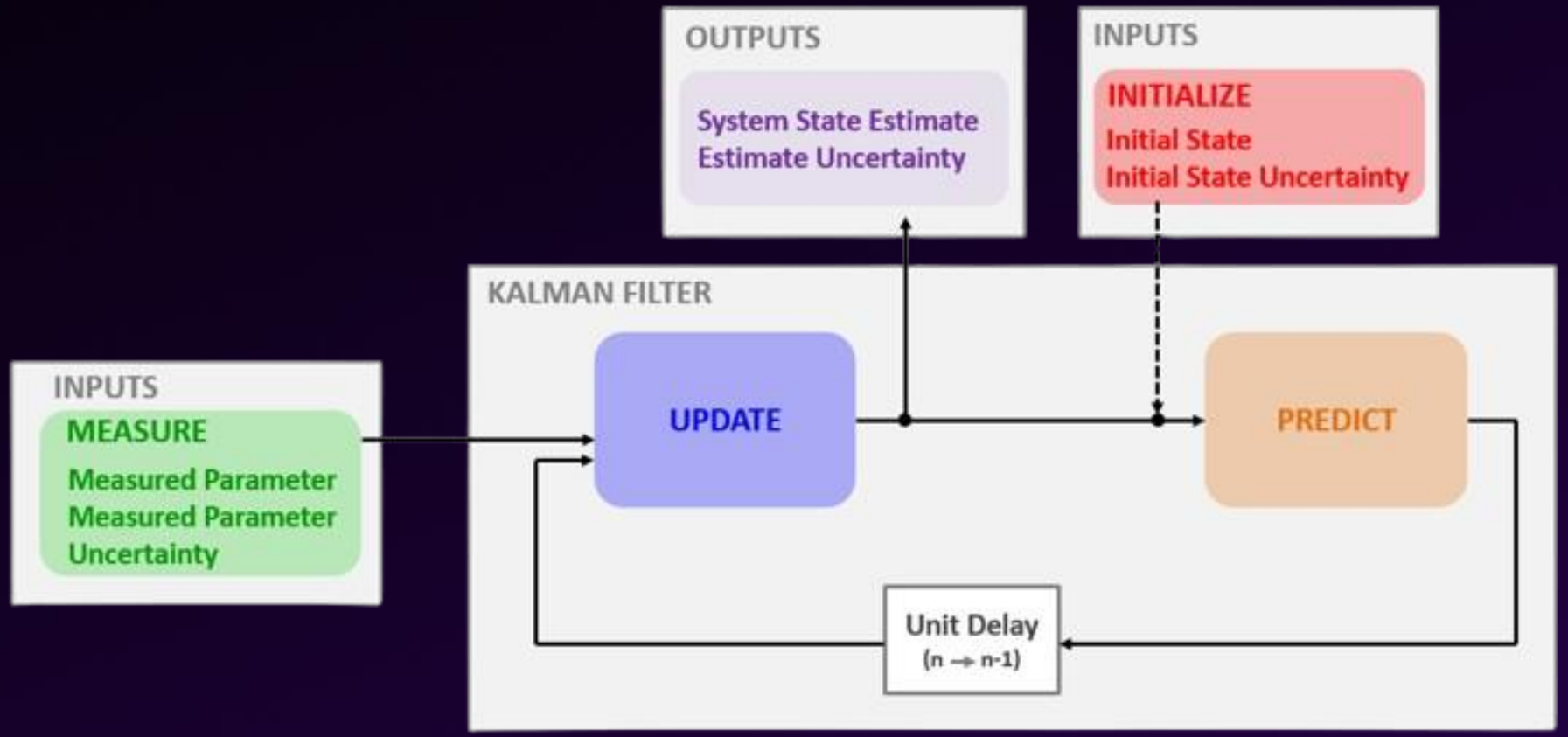
Forecast Monthly Sales

Forecasting Time Series

"Using historical data to identify patterns, which are then used to forecast how your data might behave in the future"

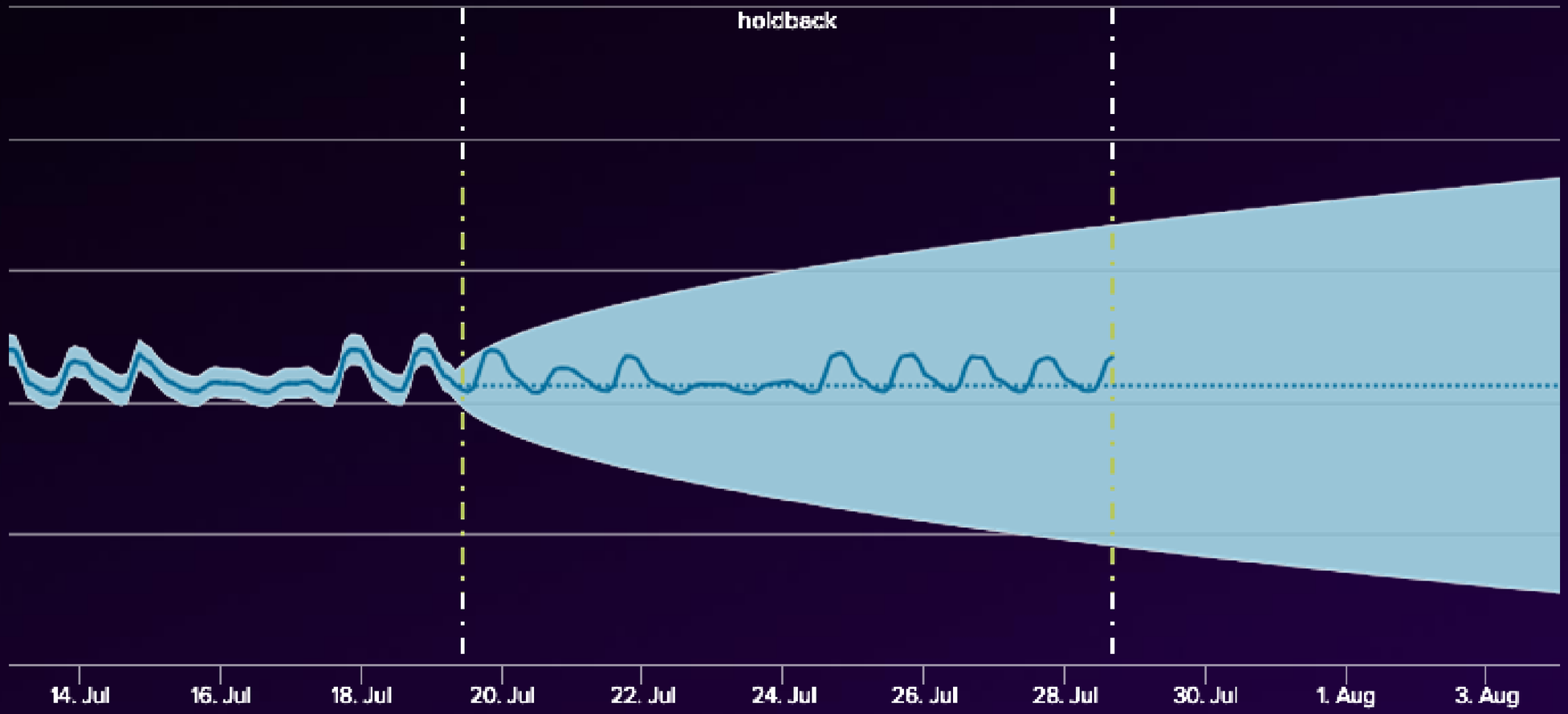
Source:Parzival'1997, flaticon.com

The Kalman Filter



Source: https://www.kalmanfilter.net/kalman1d.html

The Kalman Filter



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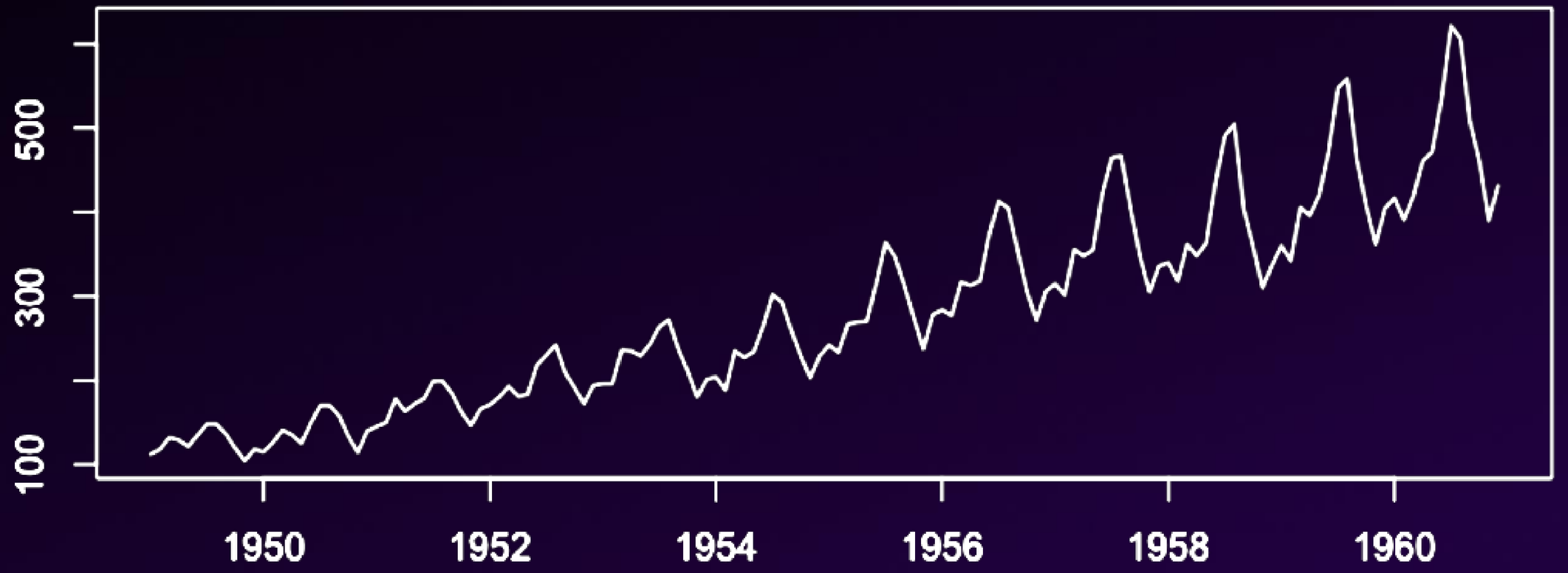
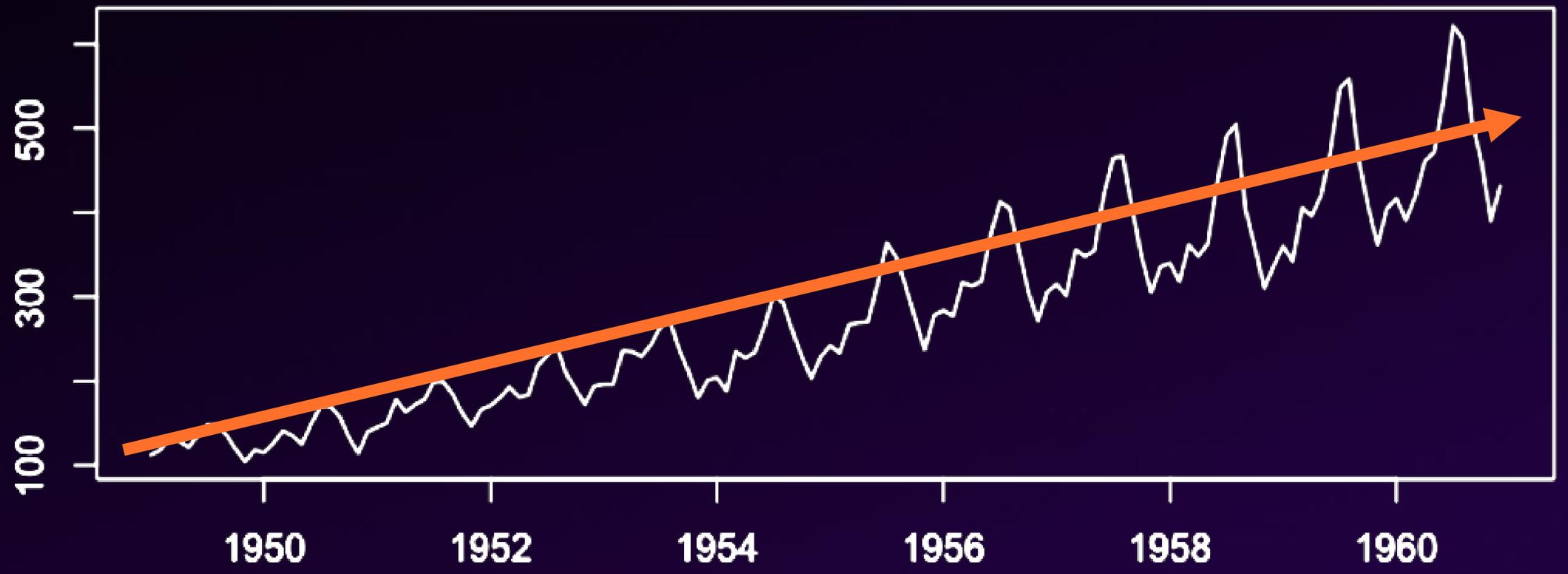
The Kalman Filter



Source: https://anomaly.io/seasonal-trend-decomposition-in-r/index.html

The Kalman Filter



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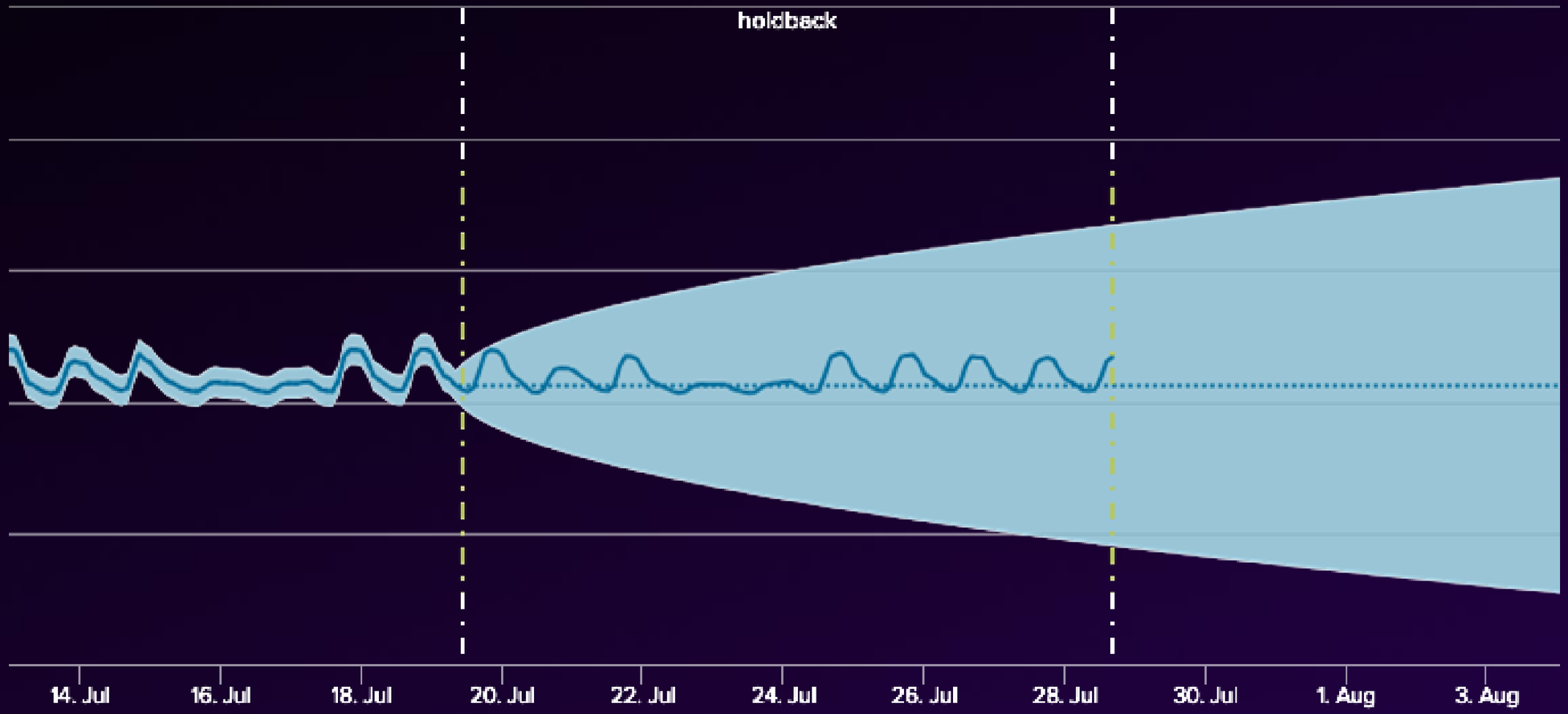
The Kalman Filter



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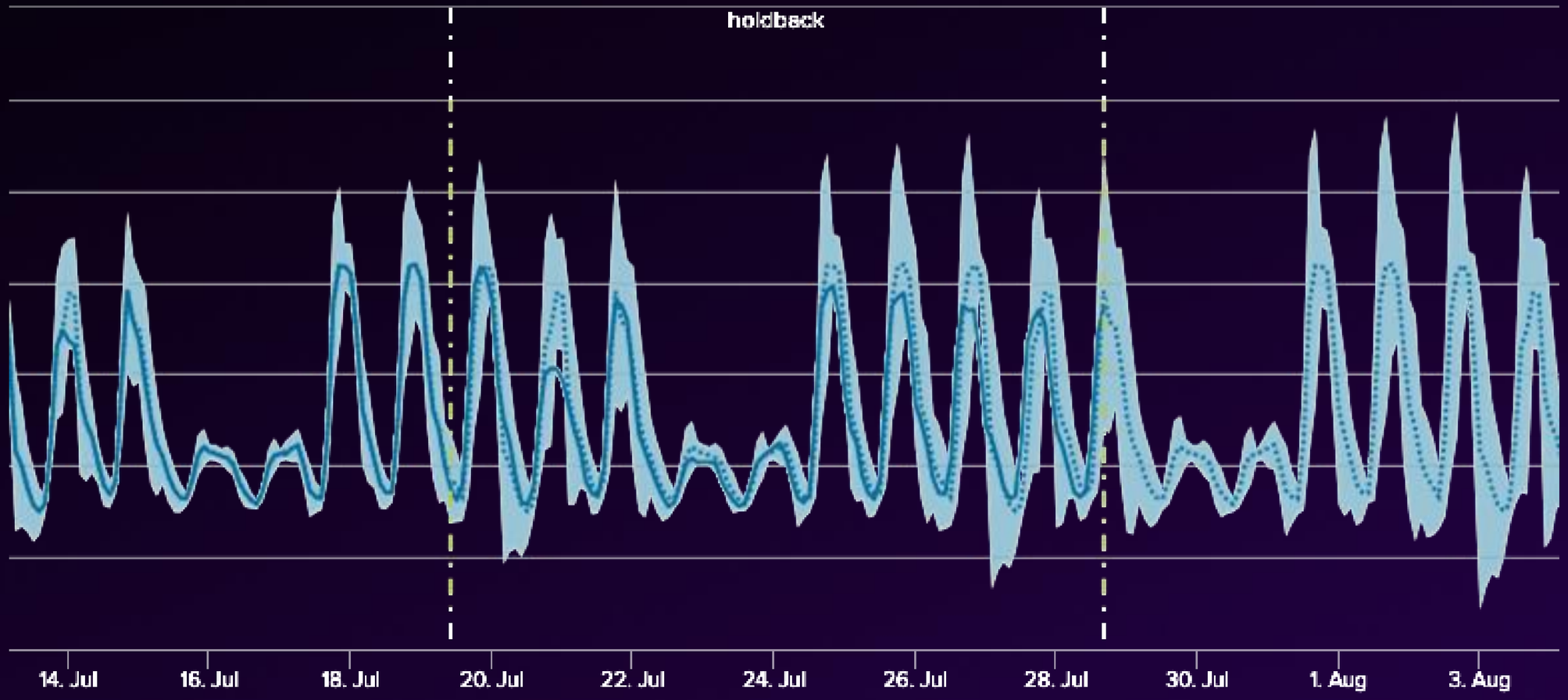
The Kalman Filter



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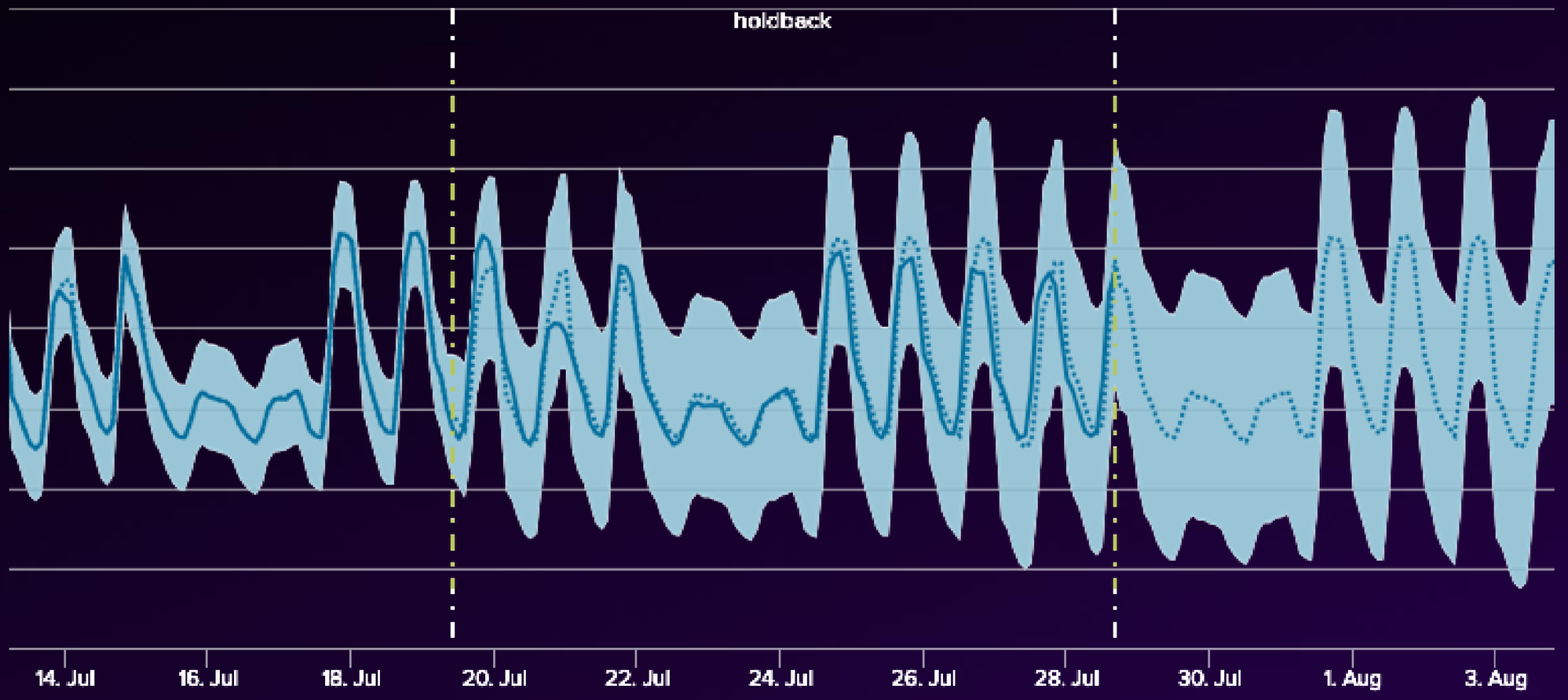
The Kalman Filter



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Live Instance Demo

Log Into [INSTANCE URL]

Exercise #2

Time: 10 minutes

Summary

Top 4 most important things to remember about forecasting time series

1

Forecasting time series is done using a **supervised learning** method

2

Models **assume historic data as a baseline**, and will self-correct accordingly

3

Parameters have a **large impact on performance**. Tuning each model is highly recommended

4

Choice of forecasting algorithm may rely on a **subject matter expert** of the data

And we’re done!

Tools in Your ML Toolkit Now

Prediction

Get ahead of issues that may happen in the future

Categorization

Uncover insights about your data to quickly respond in the present

Outlier Detection

Identify and analyze abnormal behavior in your data

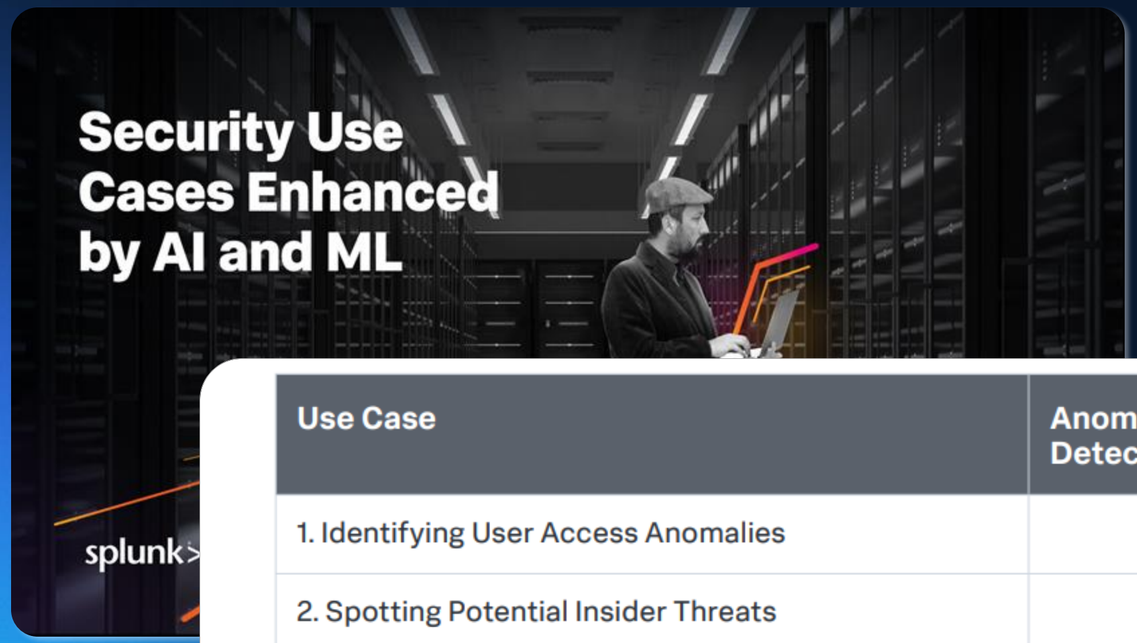
An Introductory Use Case Guide

Splunk Artificial Intelligence for Observability

Link to landing page

The table below shows how the following use cases map to the different techniques.

Use Case	Anomaly Detection	Predictive Analytics	Clustering
1. Forecasting Resource Utilization		✔	
2. Detecting Service Performance Issues	✔	✔	
3. User Experience Monitoring	✔	✔	
4. Noise Reduction			✔
5. Predicting Data Downtime in Splunk	✔	✔	
6. Predictive Maintenance	✔	✔	✔
7. Cell Tower Monitoring	✔		
8. Geohazards Monitoring	✔		



Link to landing page

Use Case	Anomaly Detection	Predictive Analytics	Clustering	Graph Analytics	Generative AI
1. Identifying User Access Anomalies	✔				
2. Spotting Potential Insider Threats	✔		✔		
3. Detecting Domain Generation Algorithms (DGA)s		✔			
4. Finding Command Line Anomalies	✔	✔			
5. Using ML for Threat Hunting	✔		✔	✔	
6. Detecting Malicious Patterns of Network Traffic	✔				
7. Detecting Fraudulent Activity	✔		✔	✔	
8. Predicting Data Downtime in Splunk	✔	✔			
9. Demystifying Security Searches with the Splunk AI Assistant					✔

Additional Resources

Getting started

- View some of our webinars
- Check out our YouTube playlist
- Check out the blog on MLTK 5.4 release
- Try out some of our starter blogs, such as Cyclical Statistical Forecasts and Anomalies, part 1
- Try our new MLTK Deep Dives

Increasing complexity

- Try part 4 or 6 of the Cyclical Statistical Forecasts and Anomalies series
- Brush up on how MLTK works with our comprehensive documentation
- Get familiar with the Workshop Guide

More advanced

- The Analytics and Data Science course
- Try out the Anomalies Are Like a Gallon of Neapolitan Ice Cream - Part 1
- Try out part 5 of the cyclical statistical forecasts and anomalies series
- Try the ML-SPL API

Thank you

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Q&A

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