Extending Splunk MLTK using GitHub Community

Gyanendra Rana **Senior Product Manager Machine Learning**

Nathan Worsham **IS Security Administrator,** pinnacol.com

October 2018

Forward-Looking Statements

During the course of this presentation, we may make forward-looking statements regarding future events or the expected performance of the company. We caution you that such statements reflect our current expectations and estimates based on factors currently known to us and that actual events or results could differ materially. For important factors that may cause actual results to differ from those contained in our forward-looking statements, please review our filings with the SEC.

The forward-looking statements made in this presentation are being made as of the time and date of its live presentation. If reviewed after its live presentation, this presentation may not contain current or accurate information. We do not assume any obligation to update any forward-looking statements we may make. In addition, any information about our roadmap outlines our general product direction and is subject to change at any time without notice. It is for informational purposes only and shall not be incorporated into any contract or other commitment. Splunk undertakes no obligation either to develop the features or functionality described or to include any such feature or functionality in a future release.

splunk> .conf18

Gyanendra Rana

- Splunk Senior Product Manager – Machine Learning
- 14 years of Software Engineering experience
- Responsible for Machine Learning Customer Advisory Program
- In my free time, I love to play with my 5 year old son

Nathan Worsham

PINNACOL ASSURANCE

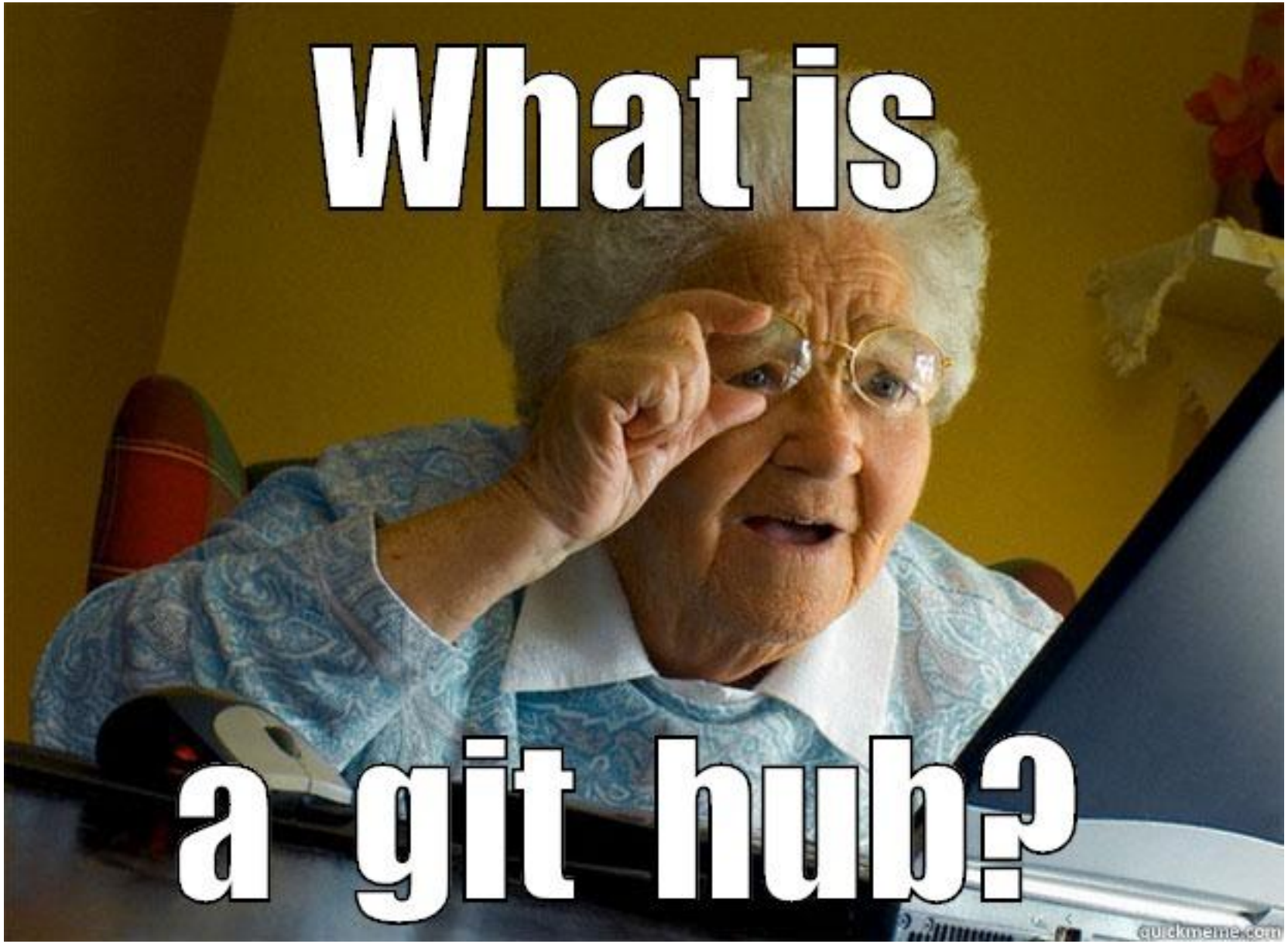
- Wear a lot of hats
  - IS Security Administrator
  - Splunk Admin and Advocate
  - GSEC, GCFA, GIAC Advisory Board
  - M.S. Data Science
- Unique view

Agenda

- **Github Details**
  - What is Github?
  - What are we Building?
  - What Problem it will solve?
  - Who will benefit from this capability?

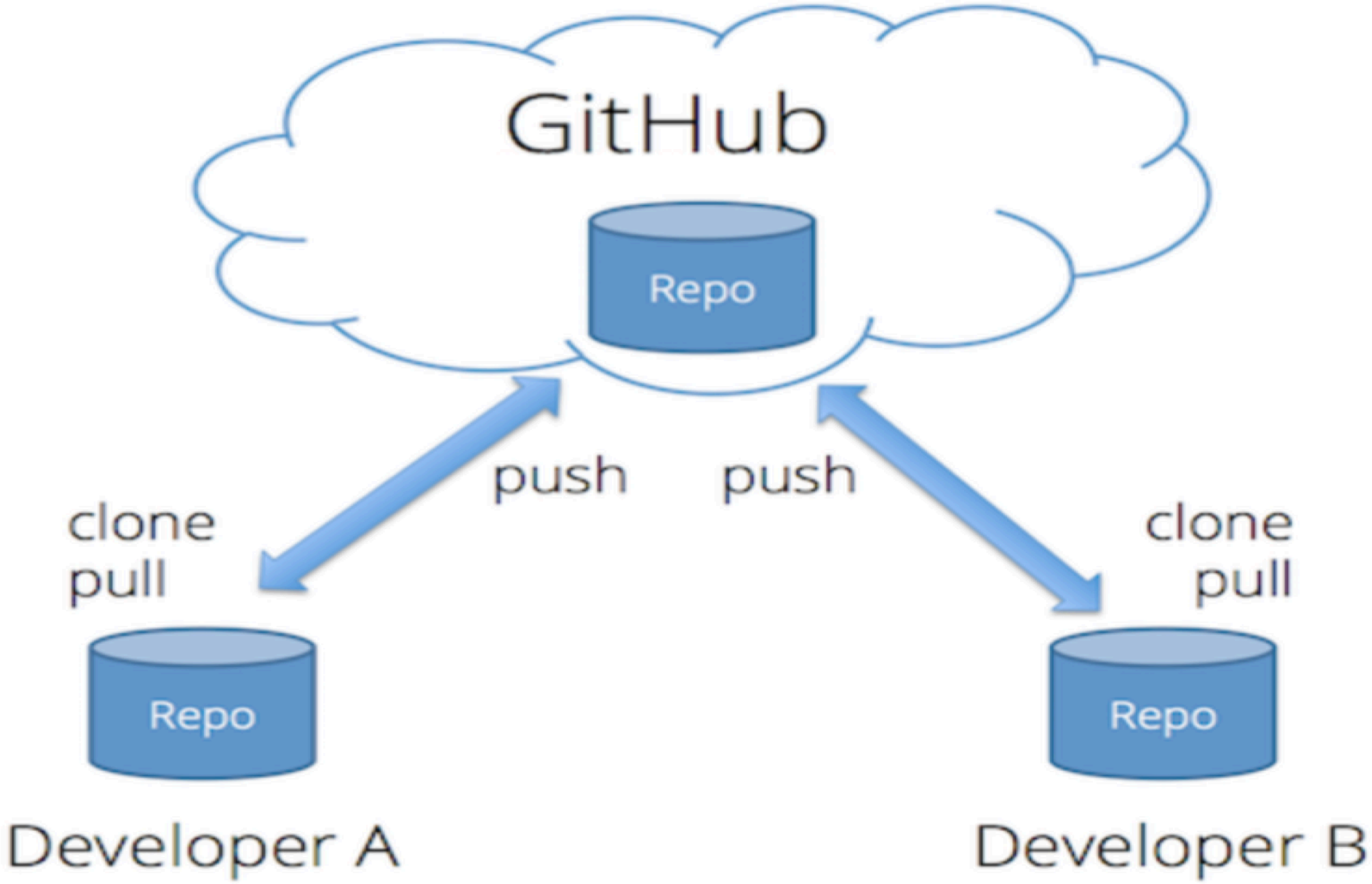
- **ML SPL API Recap**
  - ML-SPL Overview
  - Algorithms
  - Python Scientific computing Add-on
  - ML-SPL Extensibility API
  - Doc links on ML-SPL API
  - Demo

GitHub Details



What is a GitHub?

- GitHub is a web based repository and cloud-based service
- Online Code collaboration
- Version control helps developers track and manage changes to a software code
- Git is a distributed version control system.
  Entire codebase and history is available on every developer's computer for easy branching and merging
- GitHub has extra functionality on top of git
  UI, documentations, bug tracking, pull request and many more



What are we building?

- Open Source Community
- Platform for Sharing and reusing Algorithms

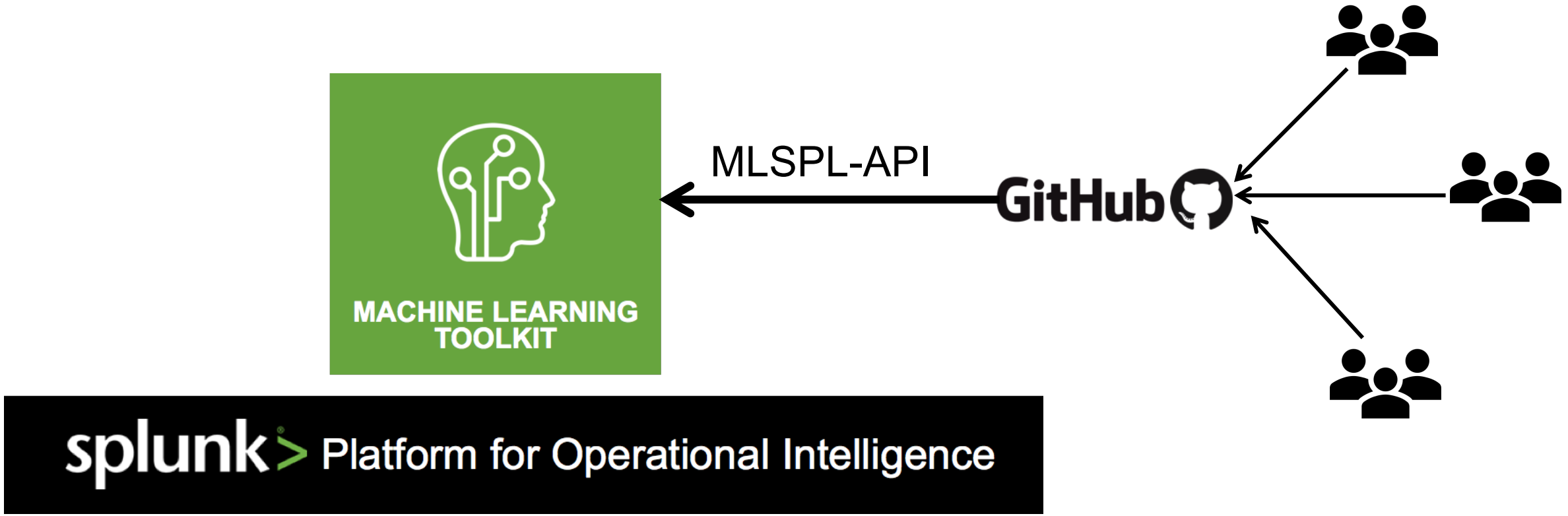
What Problem it will solve?

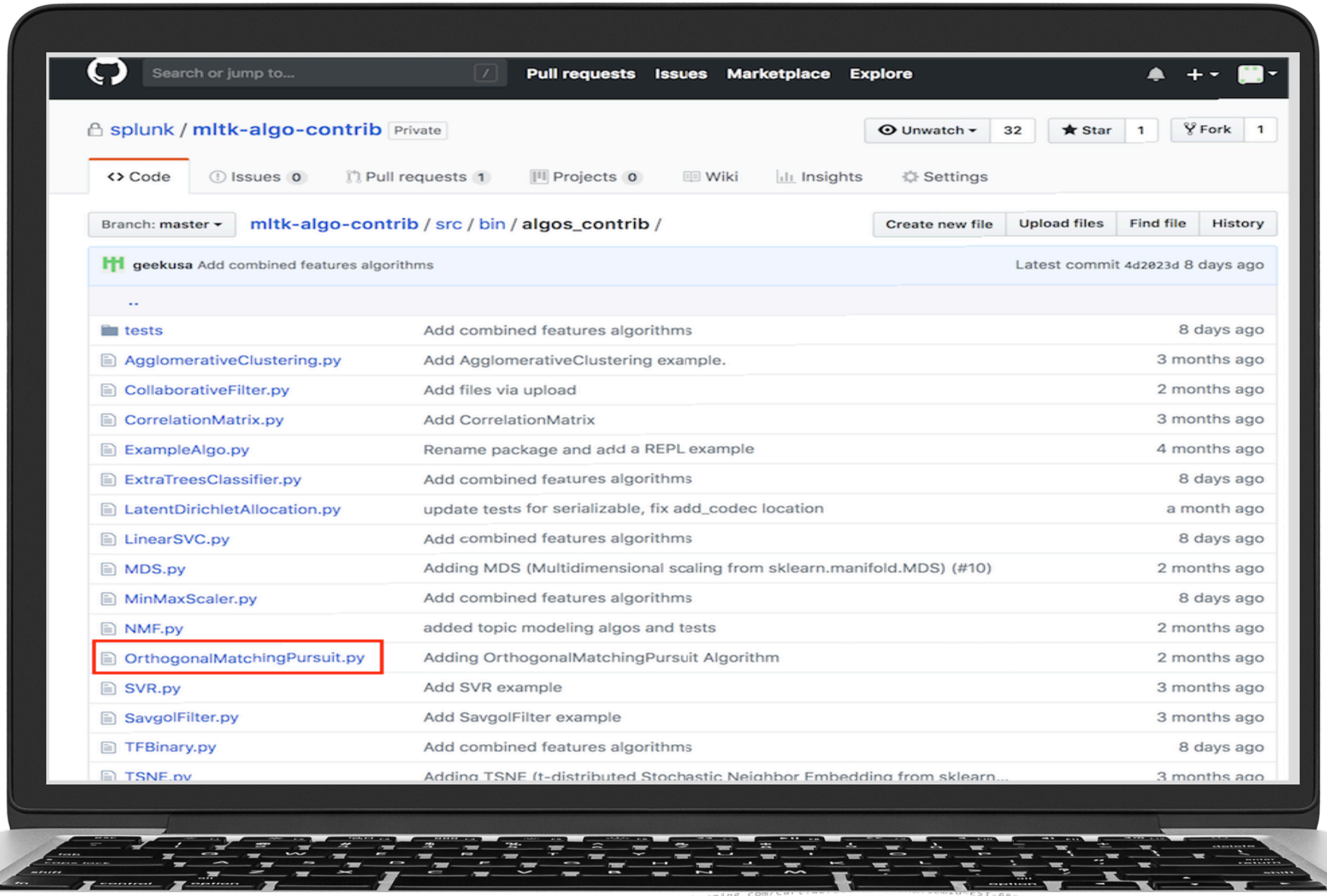
- Learning and reusing machine learning algorithms from the Splunk open source community.
- Raising issues as necessary
- “Moar” Algorithms

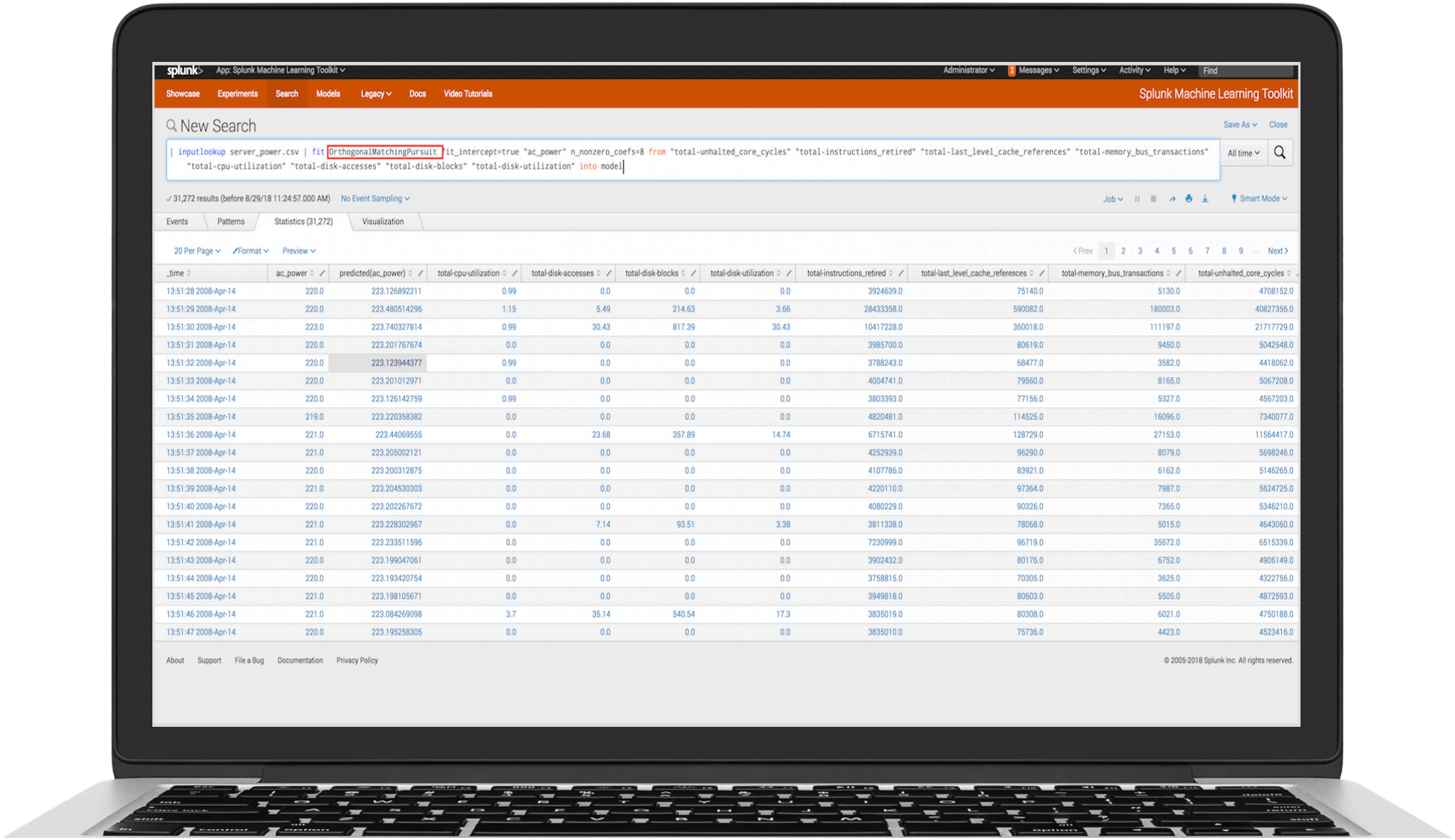
Who will benefit from this initiative ?

- Existing or new users of the MLTK will have access to more algorithms, powering new and valuable use cases in Splunk
- Customers looking for solutions that are outside of MLTK immediate 30 odd algorithms.
- Consumers of the ML-SPL API will have opportunities of sharing their custom algorithms

How does it work in Splunk?







splunk> .conf18

ML-SPL API Recap

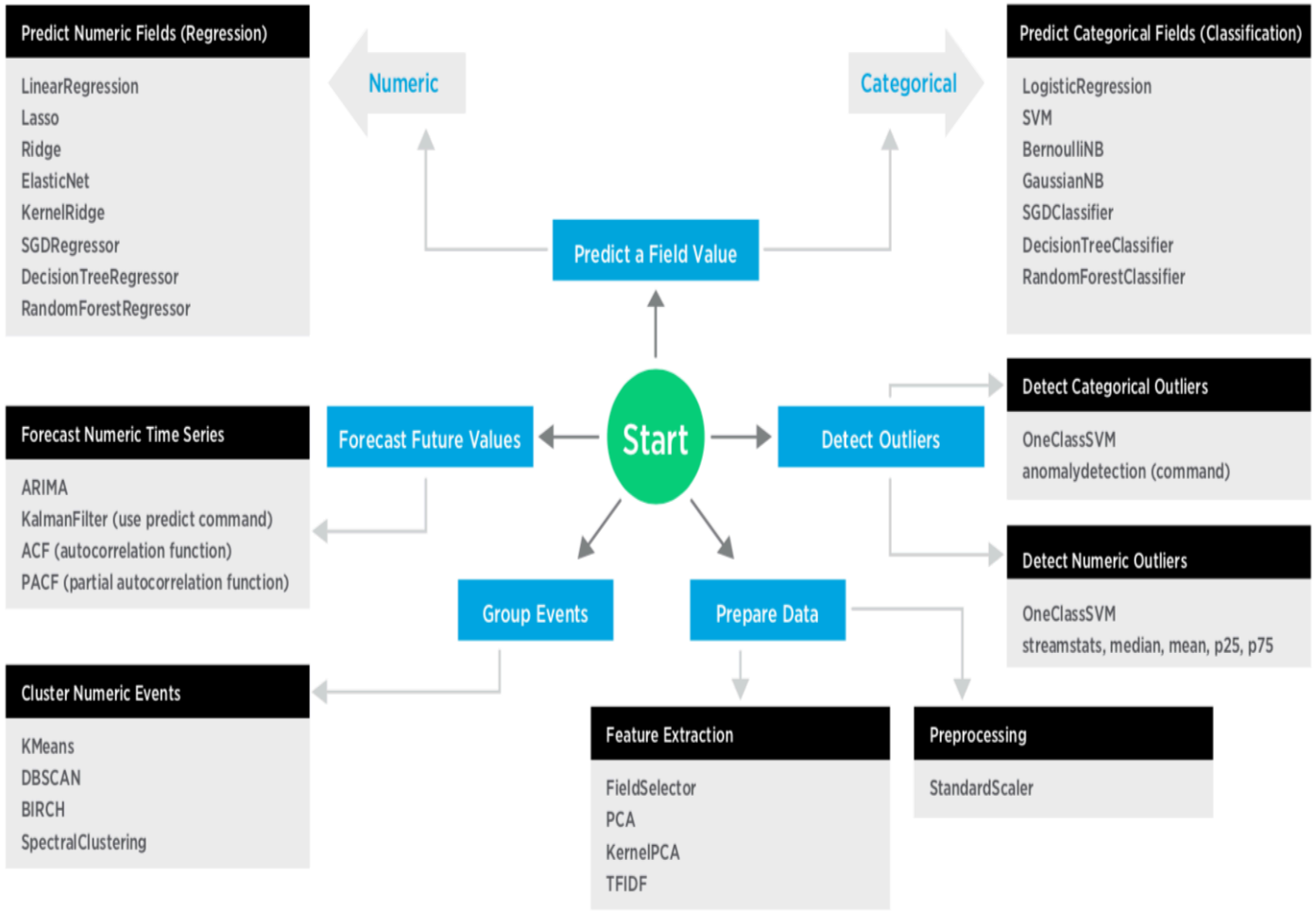
ML-SPL Overview

- A suite of SPL search commands specifically for Machine Learning:
  - **fit**
  - **apply**
  - **summary**
  - **listmodels**
  - **deletemodel**
  - **sample**

- Implemented using modules from the Python for Scientific Computing Add-on for Splunk:
  - **scikit-learn, numpy, pandas, statsmodels, scipy**

Algorithms

- 30 packaged algorithms come with the MLTK
  - **Regressors** – predicting numeric output
  - **Classifiers** – predicting categorical output
  - **Clusterers** – grouping like with like
  - **Preprocessing**
  - **Time series analysis** – e.g. ARIMA, ACF, PACF
  - **Feature extraction** – e.g. PCA, TFIDF



Python for Scientific Computing (PSC)

Free add-on available on Splunkbase

- Required dependency of the MLTK
- Provides needed libraries for ML
- Miniconda-based
- Most notable packages:
  - **scikit-learn**
  - **pandas**
  - **NumPy**
  - **SciPy**
  - **StatsModels**

ML-SPL Extensibility API

- The ML-SPL Extensibility API allows one **to add custom algorithms** that can be used with the MLTK's search commands.

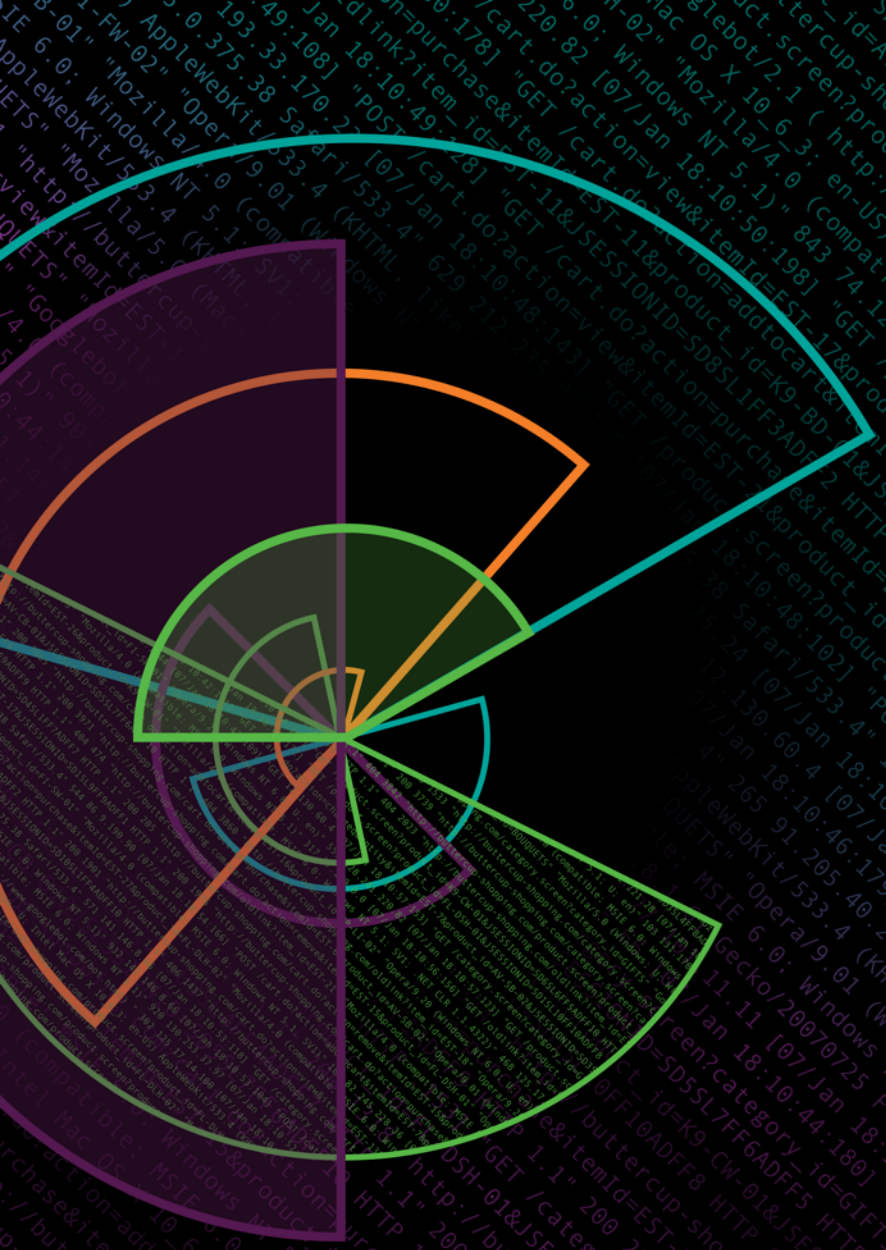
- ML-SPL API: Similar to…
  - Python SDK for custom commands API
  - Custom Visualization API (a.k.a. "modviz")
  - scitkit-learn estimator API

- Can be used in separate standalone apps too!
  - Still must have MLTK & PSC installed

Documentation

- We have ML-SPL API documentation
  http://docs.splunk.com/Documentation/MLApp/latest/API/Introduction

- Also, Checkout the last year conf presentation on ML-SPL Extensibility API :
  https://conf.splunk.com/files/2017/slides/advanced-machine-learning-using-the-extensible-ml-api.pdf



Demo

We Interrupt Your Regularly Scheduled Program

My MLTK journey

splunk> .conf18

Final Fantasy

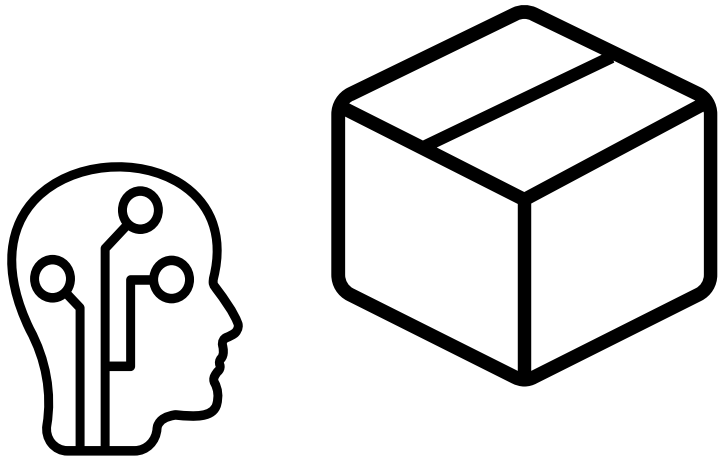
STOP the madness!

- Help our SOC only see emails of interest
- Classic binary classification problem
- But how to get there?

Something, Something... Machine Learning

***NARRATOR*: "Staring at the black box, Nathan looked uncertain."**

- Need to get email into Splunk
  - Apps for that… right?
- Process the emails for features
  - Some sort of SPL magic… right?
- Finally MLTK make a model
  - Apply model on production emails



"If you want to make an apple pie from scratch, you must first create the universe."

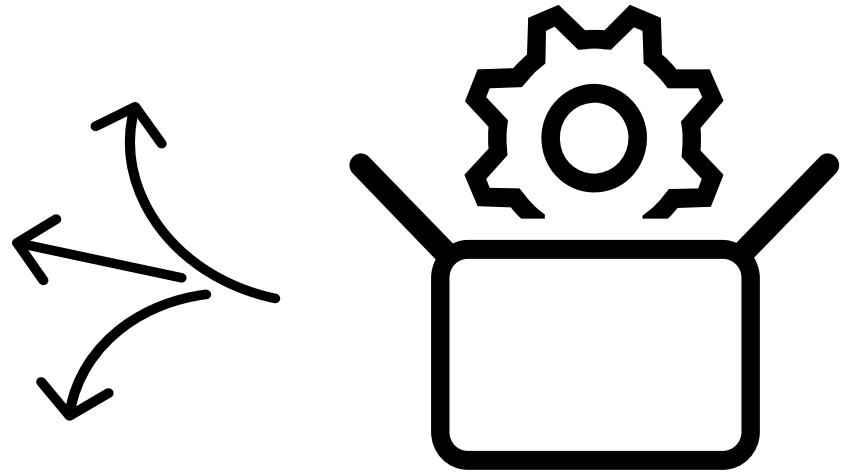
Carl Sagan

splunk> .conf18

Steps to Get There

***NARRATOR*: "Inside the box, a pair of baby shoes gleamed back at him."**

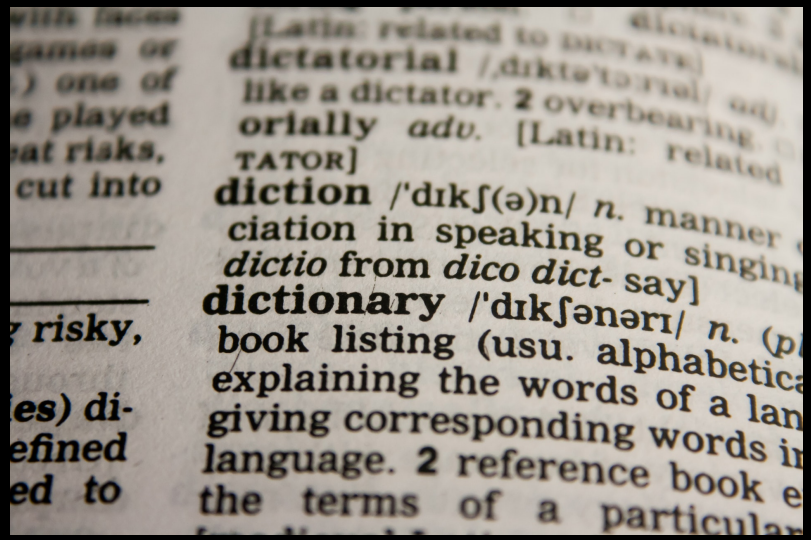
- Need to get email into Splunk
  - Tried TA-mailclient, need to fork
- Process the emails for features
  - 2 new apps, for cleaning and extraction
- Finally MLTK make a model
  - Use ML-SPL API to add algorithms



A Tale of Two Feature Sets

Emails are more than just text

- Text Features
  - Language is hard – especially for machines
  - Not literally solid… tough, see what I mean?



- Non-text features
  - ML is used to these
  - Body length, has attachment, etc

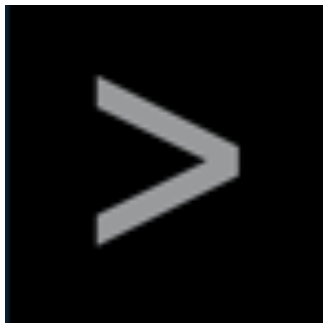
splunk> .conf18

There is One Born Every Minute

Open framework to the rescue

- Mail-Parser Plus App
  - Custom command – mailparser
  - ML friendly features

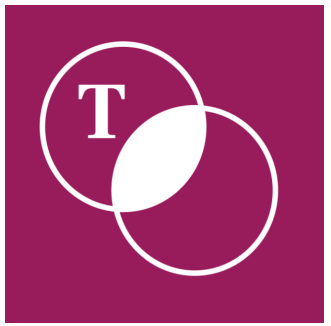
https://splunkbase.splunk.com/app/4129



Blog:
https://github.com/geekusa/nlp-text-analytics

- NLP Text Analytics App
  - Custom commands
  - MLTK custom algos
  - Dashboards

https://splunkbase.splunk.com/app/4066/



Blog:
https://github.com/geekusa/nlp-text-analytics/blob/master/PROJECT_FILES/blog.md

splunk> .conf18

Talkin' Bout My App Creation

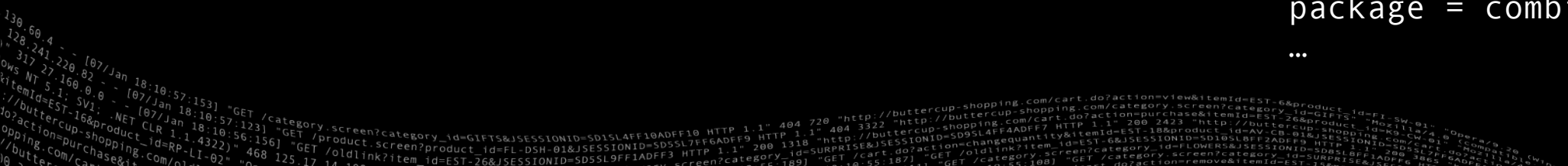
NLP Text Analytics… so far

- 3 custom commands
  - cleantext, vader, bs4
  - ***N***LTK – that's Natural Language Toolkit
  - BeautifulSoup4
- 3 primary dashboards
  - Counts (EDA), Themes (ML-Unsupervised Learning), Sentiment
- 7 Algorithms
  - Topic Modeling
  - Combined Features

- ML-SPL API file hierarchy

```
nlp_text_analytics
  └ bin
    └ topic_modeling_algos
        TruncatedSVD.py
        …
    └ combined_feats_algos
        LinearSVC.py
        …
  └ default
      algos.conf
```

```
[LinearSVC]
package = combined_feats_algos
…
```



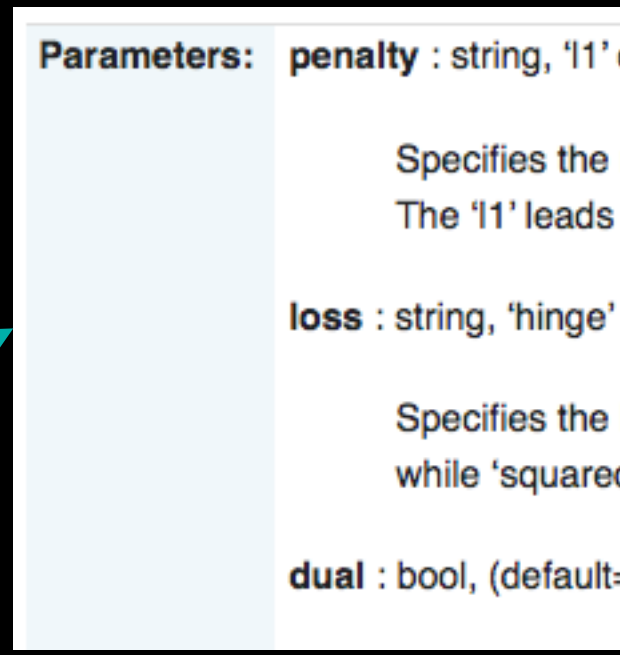
NLP Example Algo

LinearSVC.py

```
#!/usr/bin/env python
from sklearn.svm import LinearSVC as _LinearSVC
from codec import codecs_manager
from base import BaseAlgo, ClassifierMixin
from util.param_util import convert_params

class LinearSVC(ClassifierMixin, BaseAlgo):
    def __init__(self, options):
        self.handle_options(options)
        out_params = convert_params(
            options.get('params', {}),
            floats=['gamma', 'C', 'tol', 'intercept_scaling'],
            ints=['random_state','max_iter'],
            strs=['penalty', 'loss', 'multi_class'],
            bools=['dual', 'fit_intercept'])
        self.estimator = _LinearSVC(**out_params)
    @staticmethod
    def register_codecs():
        from codec.codecs import SimpleObjectCodec
        codecs_manager.add_codec('combined_feats_algos.LinearSVC', 'LinearSVC',
SimpleObjectCodec)
        codecs_manager.add_codec('sklearn.svm.classes', 'LinearSVC', SimpleObjectCodec)
```

sklearn docs



Parameters: **penalty** : string, 'l1'

Specifies the
The 'l1' leads

loss : string, 'hinge'

Specifies the
while 'squared

dual : bool, (default=

splunk> .conf18

Custom Made

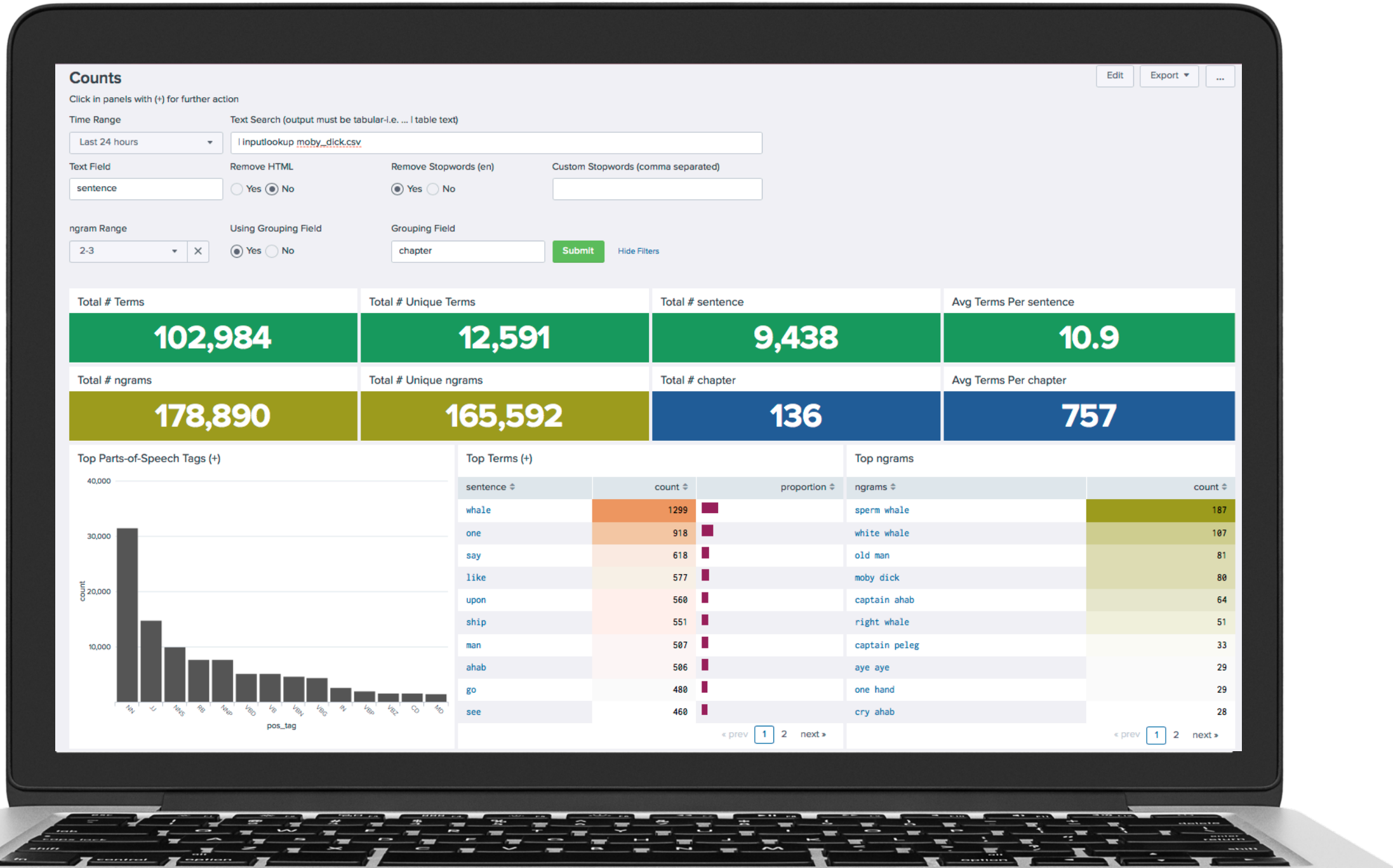
NLP Example Custom Command

- cleantext command

```
| inputlookup peter_pan.csv | table sentence | cleantext
textfield=sentence mv=f ngram_range=1-3 ngram_mix=t base_type=lemma_pos
```

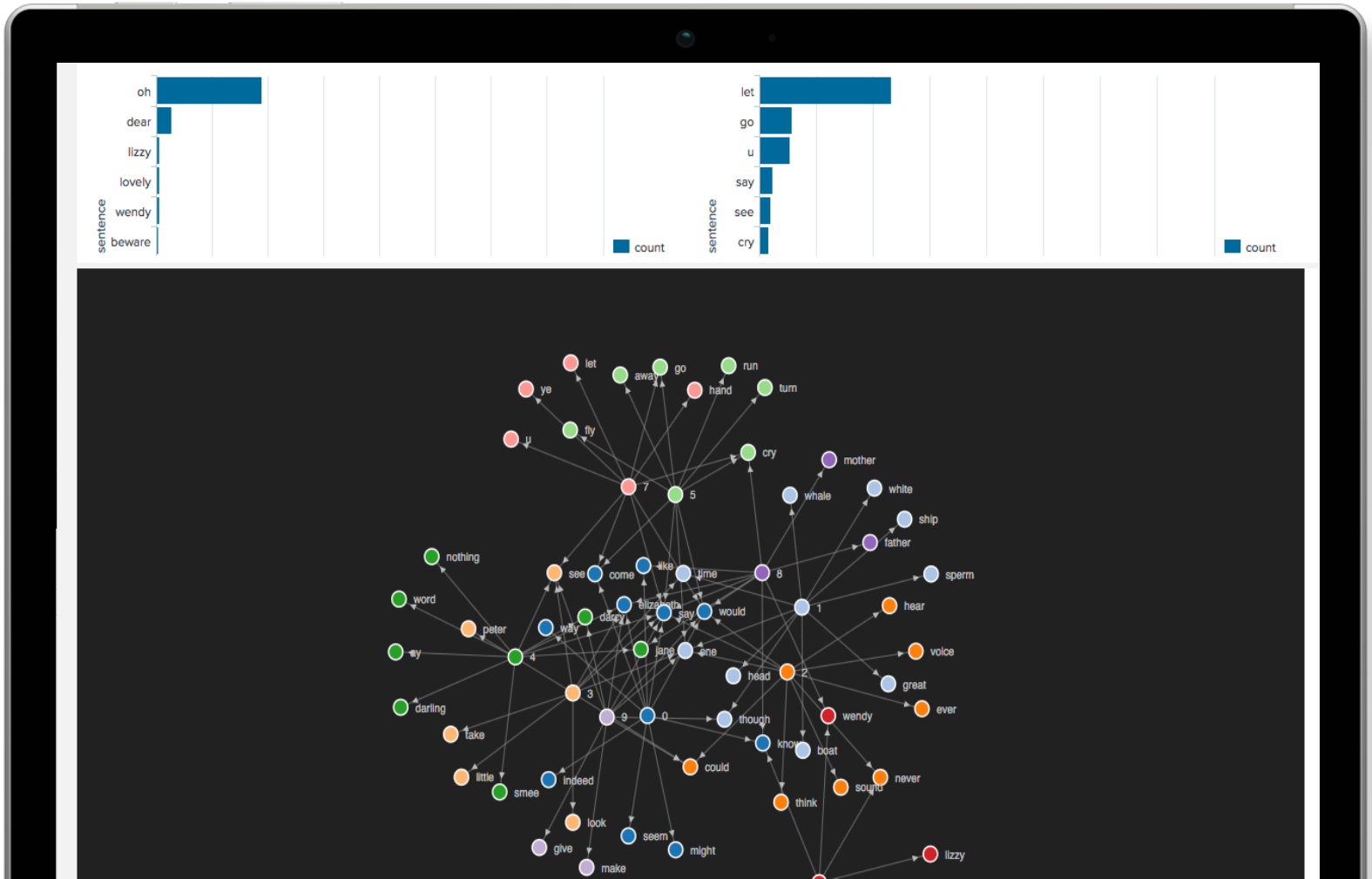
- TFIDF ready

sentence	ngrams	pos_tag	pos_tuple
child except one grow	child except except one one grow child except one except one grow	NNS IN CD VB	["child","NNS"] ["except","IN"] ["one","CD"] ["grow","VB"]
soon know grow way wendy know	soon know know grow grow way way wendy wendy know soon know grow know grow way grow way wendy way wendy know	RB VBP VB NN NNP VBD	["soon","RB"] ["know","VBP"] ["grow","VB"] ["way","NN"] ["wendy","NNP"] ["know","VBD"]
one day two year old play garden pluck another flower ran	one day	CD NN CD NNS JJ VBG NN VBD	["one","CD"]



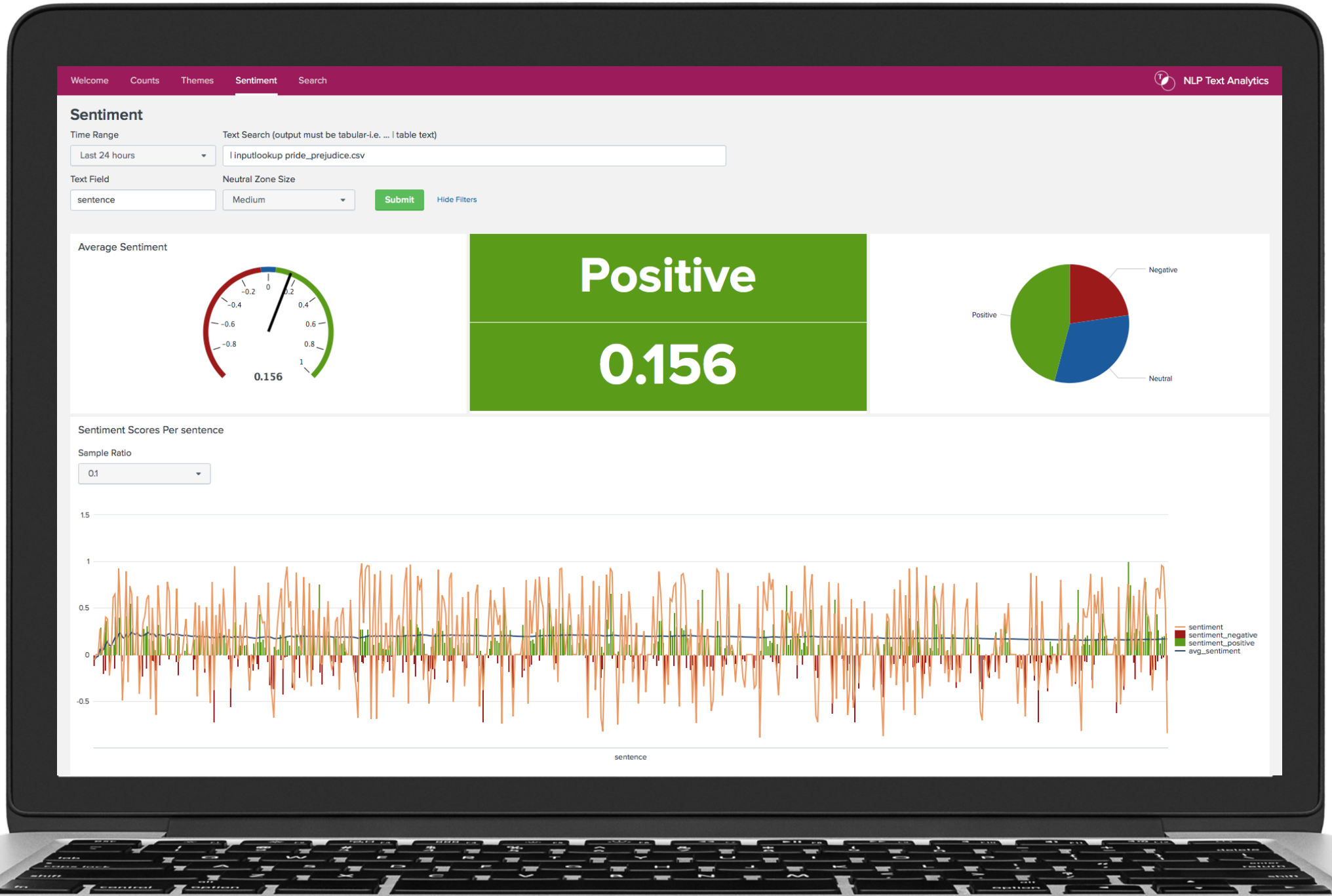
Theme Park

Themes Dashboard



- Unsupervised ML (Clustering like Kmeans)
  - Can pass through topic modeling algos first

splunk> .conf18



Don’t Forget to Tip Your Waiter

Pro tip

- `rejects` or `depends` to hide options
- Use the `` `comment("")` `` macro to turn off portions of the search

```
<input id="horiz_two_radio_1" type="radio" token="html_dummy">
  <label>Remove HTML</label>
  <choice value="Yes">Yes</choice>
  <choice value="No">No</choice>
  <change>
    <condition value="Yes">
      <set token="html_begin"></set>
      <set token="html_end"></set>
    </condition>
    <condition value="No">
      <set token="html_begin">`comment("</set>
      <set token="html_end">")`</set>
    </condition>
  </change>
  <default>No</default>
  <initialValue>No</initialValue>
```

```
<search id="base_search">
  <query>
$master_search$
$html_begin$| bs4 textfield=$textfield$ $html_end$
```

splunk> .conf18

A Matter of Great Import

| fit <imported_algo_name_here> target from features

- Algorithms imported by NLP
- Topic Modeling Algos
  - TruncatedSVD (aka LSA), LatentDirichletAllocation, NMF
- Combined Features Algos
  - MinMaxScaler, LinearSVC, ExtraTreesClassifier, TFBinary
- Shared with Splunk's MLTK GitHub Collaboration

A Perfect Fit

Binary model building

- Run search, then mailparser

```
<email search> | mailparser
```

- Under-sample majority

```
| sample 400 by target
```

- Clean the text

```
| cleantext
textfield=mail_text mv=f
```

- Change continuous in to interval

```
| rangemap
field=num_repeat_url
qt01=0-1 qt02=2-3
default=highest | rename
range AS num_repeat_url
```

- One-hot encoding numerical categories

```
| foreach date-* [ eval
<<MATCHSTR>>_{<<FIELD>>} = 1
] | fields - date_hour
date_wday | fillnull
```

- Binarize text

```
| fit TFBinary
max_features=9000
ngram_range=1-3 min_df=2
into tfbin
```

- Scale and encode

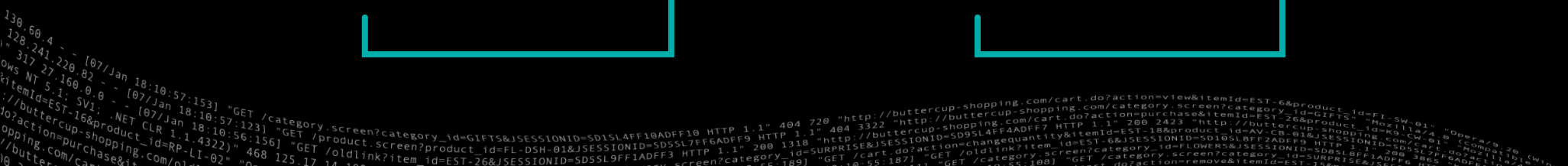
```
| fit MinMaxScaler * into
mms | fields - MMS_target*
```

- Split train/test sets (80/20)

```
|sample partitions=10
seed=1234 | search
partition_number < 8
```

- Fit to models

```
| fit LinearSVC target
from MMS_* into svc
| fit
ExtraTreesClassifier
target from MMS_* into et
| fit MLPClassifier
target from MMS_* into nn
```



splunk> .conf18

All In Favor?

VotingClassifier

- Not everything importable
- API Limitations

```
<repeat preprocessing> | apply tfbin
| apply mms | sample partitions=10 seed=1234
| search partition_number > 7
| apply svc as v1 | apply et as v2 | apply nn
as v3 | eval vote =
case(v1==‘v2’,v1,v1==‘v3’,v1,true(),v2)
```

target	v1	v2	v3	vote
investigate	investigate	investigate	investigate	investigate
investigate	investigate	investigate	investigate	investigate
investigate	investigate	investigate	investigate	investigate
investigate	investigate	investigate	investigate	investigate
investigate	investigate	ignore	investigate	investigate
investigate	investigate	investigate	ignore	investigate

splunk> .conf18

Afraid of Commitment

Me too

- Not a “real” developer?
  - Don’t let that stop you, it didn’t for me
- Need help, just ask
  - Nerds like to be heros

https://dont-be-afraid-to-commit.readthedocs.io/en/latest/git/git.html

If I Could Turn Back Time

Had the Collaboration Repo Existed

- Less time struggling
- More time doing

I Hope You Brought Enough to Share

MORE is BETTER!

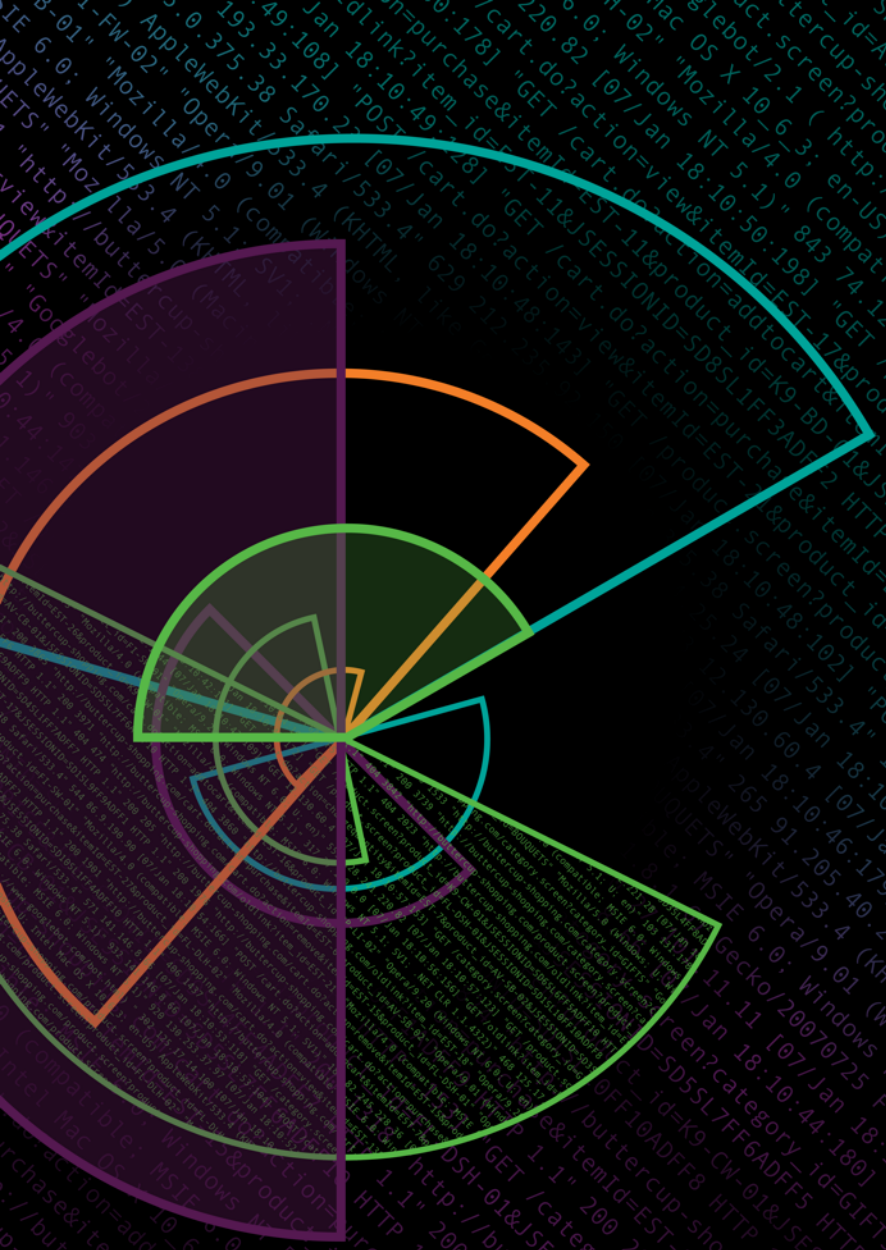
- Stand on shoulders of giants
- Single source for MLTK expansion
- Pretty please

Branching Out

Tips for importing new algos

- README.md
- Find similar algorithm
  - from sklearn.***class***
- Codecs are tricky
  - Use Python's dir() function

```
$SPLUNK_HOME/bin/splunk cmd python
> import sklearn.classname as lookhere
> dir(lookhere)
```



Q&A

splunk> .conf18

Thank You

Don't forget to rate this session in the .conf18 mobile app