Pandas vs Koalas: The Ultimate Showdown

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Sadly, we won't be talking about this ...

But we will be talking about DS at Scale ...

... which is just as good!

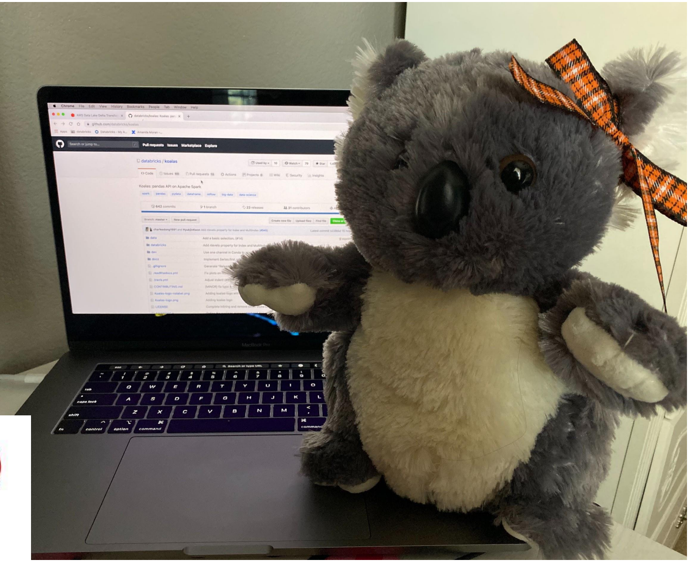
- Introduction to doing Data Science at Scale
- A few words on Pandas
- What is Apache Spark?
- What is Koalas?
- Demo
- Ultimate Showdown!

A Little about Amanda ...

- Solutions Architect @ Databricks
- MS Computer Science, BS Biology
- Previously: HP, Teradata, DataStax, Esgyn
- PMC and Apache Committer on Apache Trafodion
- 5 Different Distributed Systems
- Instructor for Udacity Data Engineering Nanodegree

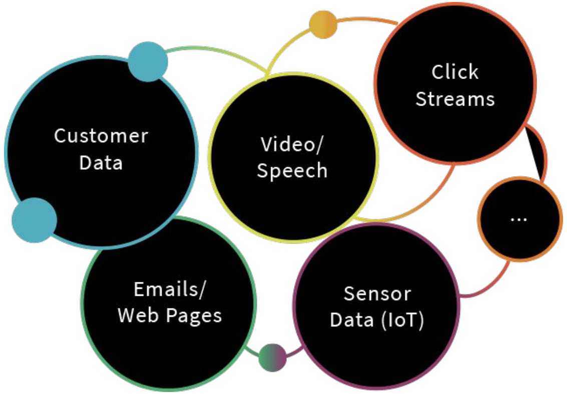
Let’s have a Contest!

- If you want to win this Koala:
  - Create a great live tweet on Twitter
  - Tag me **@AmandaK_Data**
  - Use the hashtag
    - **#pydataNYCKoalas**
    - **#pyspark**
- Stick around after the talk



Why Should a Data Scientist Care about Scale?

- Huge amounts of data from many sources
  - Click steam, Customers data, IOT, video/speech
  - And this isn't going away -- only growing
- Large data + simple algorithms = better models
- Documented by Google in 2009
  - White Paper: *The Reasonable Effectiveness of Data*



EXPERT OPINION

Contact Editor: **Brian Brannon,** bbrannon@computer.org

The Unreasonable Effectiveness of Data

What is Pandas?

pandas

$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$

- Authored by Wes McKinney in 2008
- The standard Python tool for data manipulation/analysis
- Can deal with a lot of different situations, including:
  - Basic statistical analysis
  - Handling missing data
  - Time series, categorical variables, strings

Why Pandas?

Easy to start with Pandas

- Default choice for teaching
- Easy to install and use on any laptop
- Easy to write tests with all the python
- Huge community
- Enormous API for data manipulation
- Integration with visualization, ML tools

What is Apache Spark?

- Open Source
- De facto unified analytics engine for large-scale data processing
  - Streaming
  - ETL
  - Machine Learning
- PySpark API for Python
  - API support also for Scale, R, SQL

What's Wrong with PySpark?

- Nothing at all
- But integration isn't seamless
  - Both have dataframes

Pandas

- Standard for *single machine* workloads
- Small data

Apache Spark

- Standard for *distributed* workloads
- Big data

What’s Wrong with PySpark?

Pandas DataFrame vs Spark DataFrame

	pandas DataFrame	Spark DataFrame
Mutability	Mutable	Immutable

Value count	df[‘col’].value_counts()	df.groupBy(df[‘col’]).count()
		.orderBy(‘count’, ascending = False)

Pandas vs PySpark

Pandas

```
import pandas as pd
df =
pd.read_csv("my_data.csv")

df.columns = ['x', 'y', 'z1']

df['x2'] = df.x * df.x
```

PySpark

```
df = (spark.read
    .option("inferSchema", "true")
    .option("comment", True)
    .csv("my_data.csv"))

df = df.toDF(‘x’, ‘y’, ‘z1’)

df = df.withColumn(‘x2’, df.x*df.x)
```

What is Koalas?

- Announced April 24, 2019
- Pure Open Source Python library
- Aims at providing the pandas API on top of Apache Spark:
  - Unifies the two ecosystems with a familiar API
  - Seamless transition between small and large data

What is good about Koalas?

- Be immediately productive with Spark
  - No learning curve
- Have a single codebase that works both with pandas
  - Tests
  - Small datasets
  - Spark distributed datasets
  - Large datasets

Pandas vs Koalas

Pandas

```
import pandas as pd
df =
pd.read_csv("my_data.csv")

df.columns = ['x', 'y', 'z1']

df['x2'] = df.x * df.x
```

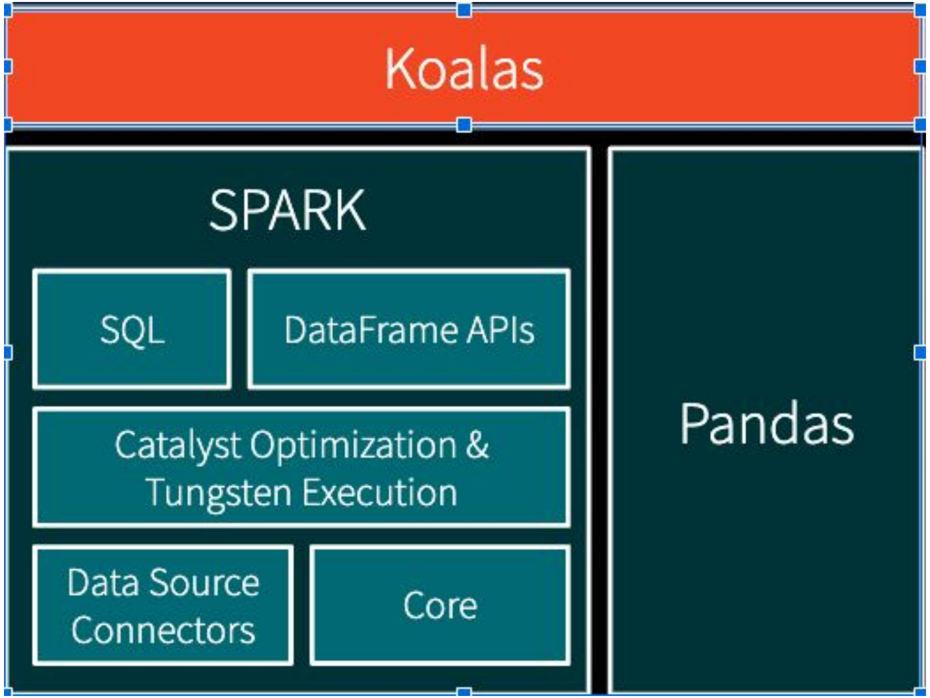
Koalas

```
import databricks.koalas as ks
df = ks.read_csv("my_data.csv")

df.columns = ['x', 'y', 'z1']

df['x2'] = df.x * df.x
```

Koalas Architecture



Koalas

SPARK

SQL

DataFrame APIs

Catalyst Optimization & Tungsten Execution

Data Source Connectors

Core

Pandas

Demo

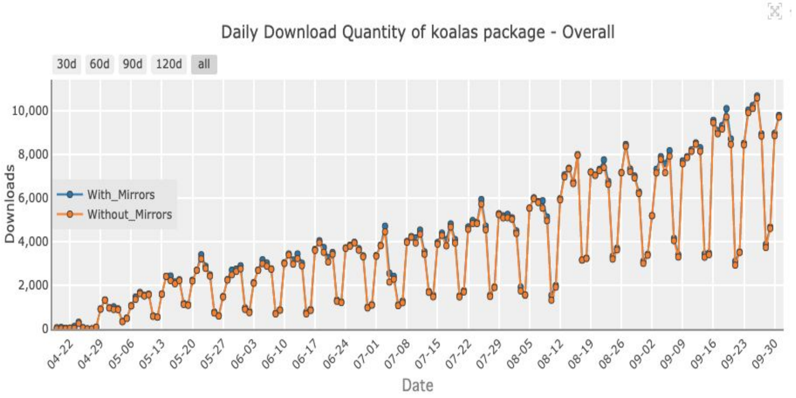
Ultimate Showdown: Who is the Winner?

- YOU!
  - More tools to be productive
- Koalas for scale
- pandas for learning and small data

Quickly Gaining Traction

- Bi-weekly releases!
- > 500 patches merged since announcement
- > 20 significant contributors outside of Databricks
- > 8k daily downloads

Downloads last day: 9,724
Downloads last week: 56,516
Downloads last month: 216,658



Status

- Bi-weekly releases, very active community with daily changes

- The most common functions have been implemented:
  - 60% of the DataFrame / Series API
  - 60% of the DataFrameGroupBy / SeriesGroupBy API
  - 15% of the Index / MultiIndex API
  - to_datetime, get_dummies, …

How to Get Started

- `pip install koalas`
- `conda install koalas`
  - More instructions on https://github.com/databricks/koalas
- Documentation
  - https://koalas.readthedocs.io/en/latest/
- Databricks Community Edition:
  - https://databricks.com/signup/signup-community

Get Involved!

- Contribute to the code
  - https://github.com/databricks/koalas

This talk:

- Notebooks and Slides
  - https://github.com/amandamoran/pydatanyc

SCAN ME

Thank you!