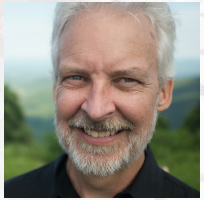
NLP SUMMIT

Presented by John Snow LABS

Ray for NLP



Dean Wampler

Principal Software Engineer

Domino Data Lab (formerly Anyscale)

@deanwampler

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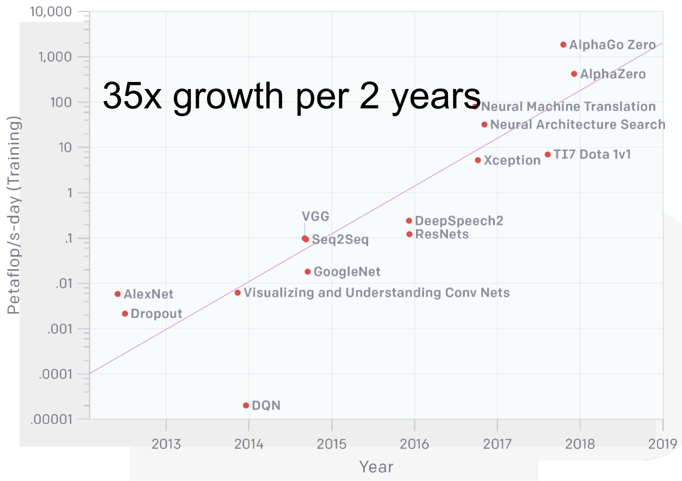
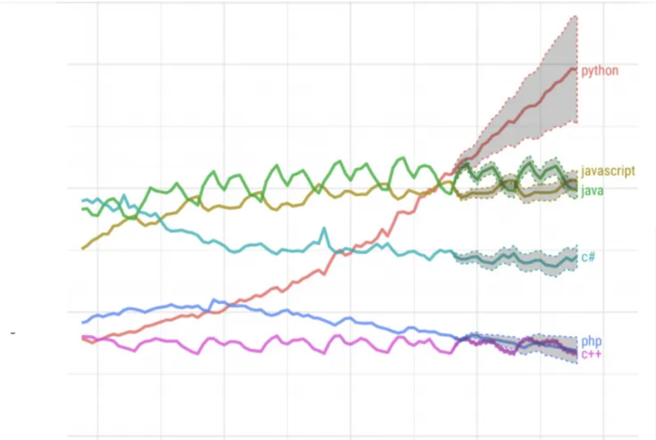
Why Ray

- Model sizes and compute requirements are growing rapidly.
- Python is the dominant data science programming language.
- ray.io





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@deanwampler

How to scale Python in N easy steps!

```
def make_array(…):
    a = … # Construct a NumPy array
    return a


def add_arrays(a, b):
    return np.add(a, b)
…
```

The Python you know…

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How to scale Python in N easy steps!

```python
@ray.remote
def make_array(…):
    a = … # Construct a NumPy array
    return a

@ray.remote
def add_arrays(a, b):
    return np.add(a, b)
…
```

Turn a function into a task.

```python
# for completeness, start with:

import ray
import numpy as np

ray.init(…)
```

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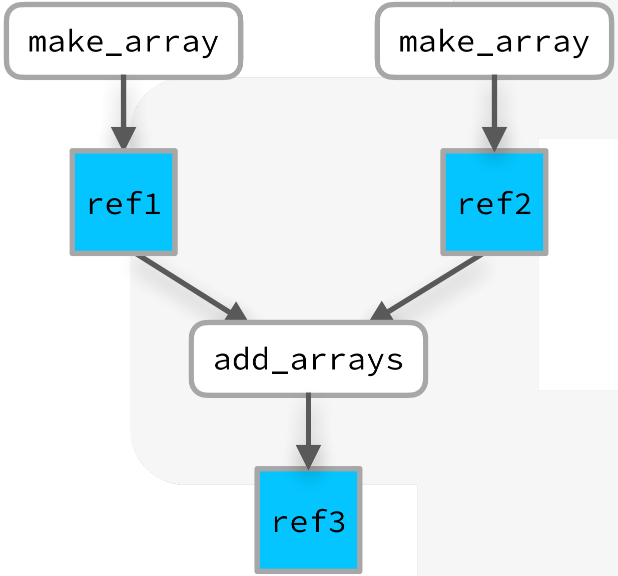
How to scale Python in N easy steps!

```
…
ref1 = make_array.remote(…)
ref2 = make_array.remote(…)
ref3 = add_arrays.remote(ref1, ref2)
```

Start a task with remote.



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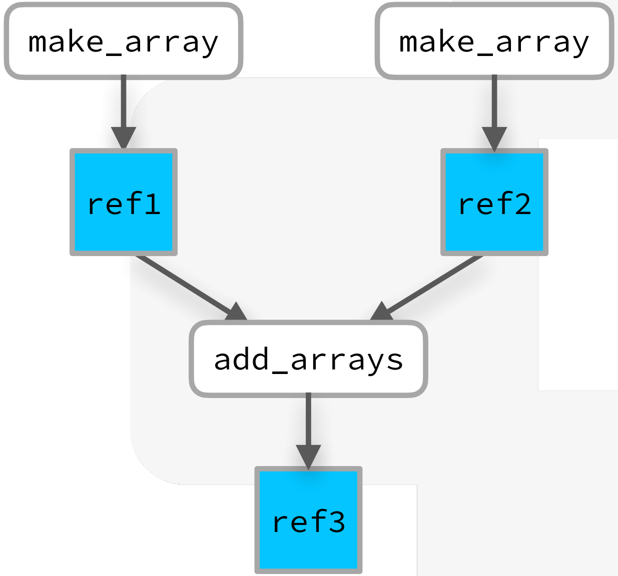
How to scale Python in N easy steps!

```
…
ref1 = make_array.remote(…)
ref2 = make_array.remote(…)
ref3 = add_arrays.remote(ref1, ref2)
array = ray.get(ref3)
```

Fetch the computed value



How to scale Python in N easy steps!

```
…
ref1 = make_array.remote(…)
ref2 = make_array.remote(…)
ref3 = add_arrays.remote(ref1, ref2)
array = ray.get(ref3)
```

No need to call ray.get() for these first!

Ray handles cluster scheduling, async computing

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How to scale Python in N easy steps!

```
…
ref1 = make_array.remote(…)
ref2 = make_array.remote(…)
ref3 = add_arrays.remote(ref1, ref2)
array = ray.get(ref3)
```

What about Distributed state??

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How to scale Python in N easy steps!

```
…
ref1 = make_array.remote(…)
ref2 = make_array.remote(…)
ref3 = add_arrays.remote(ref1, ref2)
array = ray.get(ref3)
```

```
class Counter(object):
    def __init__(self):
        self.value = 0
    def increment(self):
        self.value += 1
        return self.value
```

The Python classes you love

How to scale Python in N easy steps!

```
…
ref1 = make_array.remote(…)
ref2 = make_array.remote(…)
ref3 = add_arrays.remote(ref1, ref2)
array = ray.get(ref3)
```

```
@ray.remote
class Counter(object):
    def __init__(self):
        self.value = 0
    def increment(self):
        self.value += 1
        return self.value
    def get_count(self):
        return self.value
```

From class to “actor”

Must add a getter method

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How to scale Python in N easy steps!

```
…
ref1 = make_array.remote(…)
ref2 = make_array.remote(…)
ref3 = add_arrays.remote(ref1, ref2)
array = ray.get(ref3)
```

```
…
c = Counter.remote()
ref4 = c.increment.remote()
rer5 = c.increment.remote()
ray.get([ref4,ref5]) # [1, 2]
```

Same idioms

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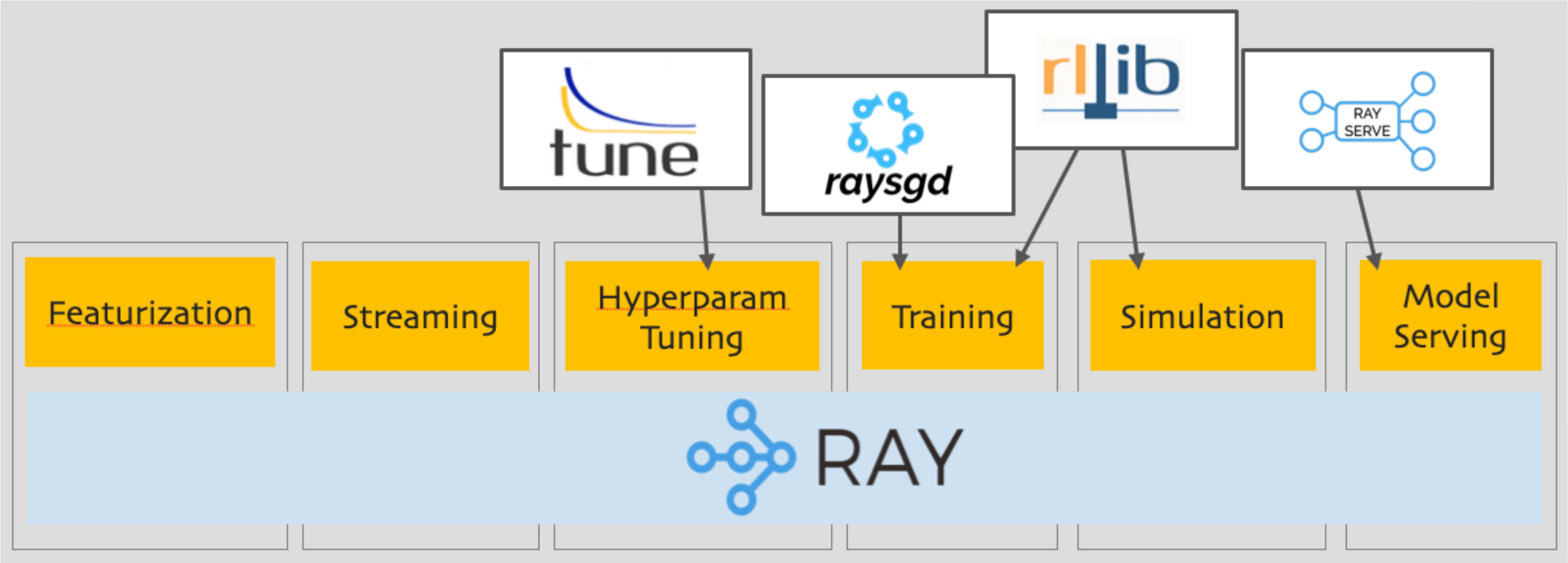
But you may never use the Ray API…



[ray.io](ray.io)

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@deanwampler

But you may never use the Ray API…

huggingface.co

Hugging Face Transformers

Since NLP model training is $$$$$, it's easier to use **transfer learning:**

- Start with a pre-trained model
- Add a few more layers
- Train for a few epochs for a particular application
- Profit?

Transformers

github.com/huggingface/transformers

Hugging Face Transformers

Well, hyper-parameter tuning is also expensive and it can be tricky.

- Avoiding local minima: arxiv.org/abs/1811.01088
- High variance in results common: github.com/pytorch/fairseq/blob/master/examples/roberta/wsc

🤗 Transformers

github.com/huggingface/transformers

credit: Thomas Wolf, *Transfer Learning in NLP: Concepts, Tools & Trends* (Ray Summit 2020)

Hugging Face Transformers

Using Ray Tune You can get 1.5% better results using *Bayesian Optimization*, 5% better using *Population-Based Training* for the same compute resources.

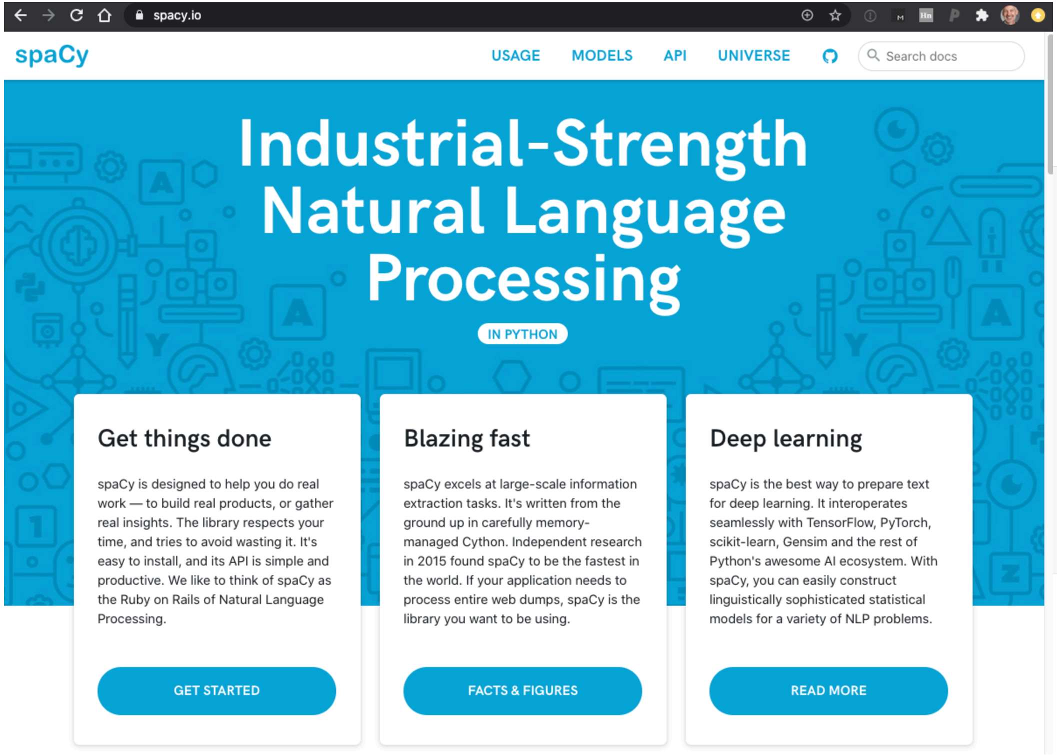
- See this blog post (Ray blog on Medium)

tune.io

Hyper-parameters:

- learning rate
- weight decay
- # of epochs
- per-GPU batch size

But you may never use the Ray API...



spacy.io

spaCy v3

spaCy v3 release will introduce a new integration with Ray, which will bring effortless parallel and distributed training to spaCy.

- github.com/explosion/spacy-ray
- Matthew Honnibal, Why spaCy Is Going with Ray (Ray Summit 2020)

explosion.ai

spaCy v3

```
$ python -m spacy train …
```

CLI without spacy-ray

```
$ pip install spacy-ray
$ python -m spacy ray train --n-workers 2 …

# “spacy ray pretrain” and “spacy ray parse”
# are planned.
```

Parallel and distributed training with spacy-ray

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spaCy v3

spaCy v3 includes changes to the data model and some pipeline improvements. The Ray support is not a lot of code:

- Shard parameters into distributed state with Ray actors.
- Train on local shard.
- Asynchronously receive updates from other actors.
- Merge updates.
- Repeat...

CLI without spacy-ray

Parallel and distributed training with spacy-ray

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Your uses of Ray for NLP?

Ray's flexible *task* model can be used for course- and fine-grained computation. The *actor* model makes "sharded", distributed state intuitive to manage. So, use it for:

- Tokenization and other data prep
- Distributed training: Ray Tune and Ray SGD for easier distributed TensorFlow and PyTorch
- Simple, scalable model serving with Ray Serve

ray.io

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Ray in NLP

The creators of Hugging Face and spaCy and the how they use Ray. See the Anyscale blog and YouTube channel.

raysummit.org

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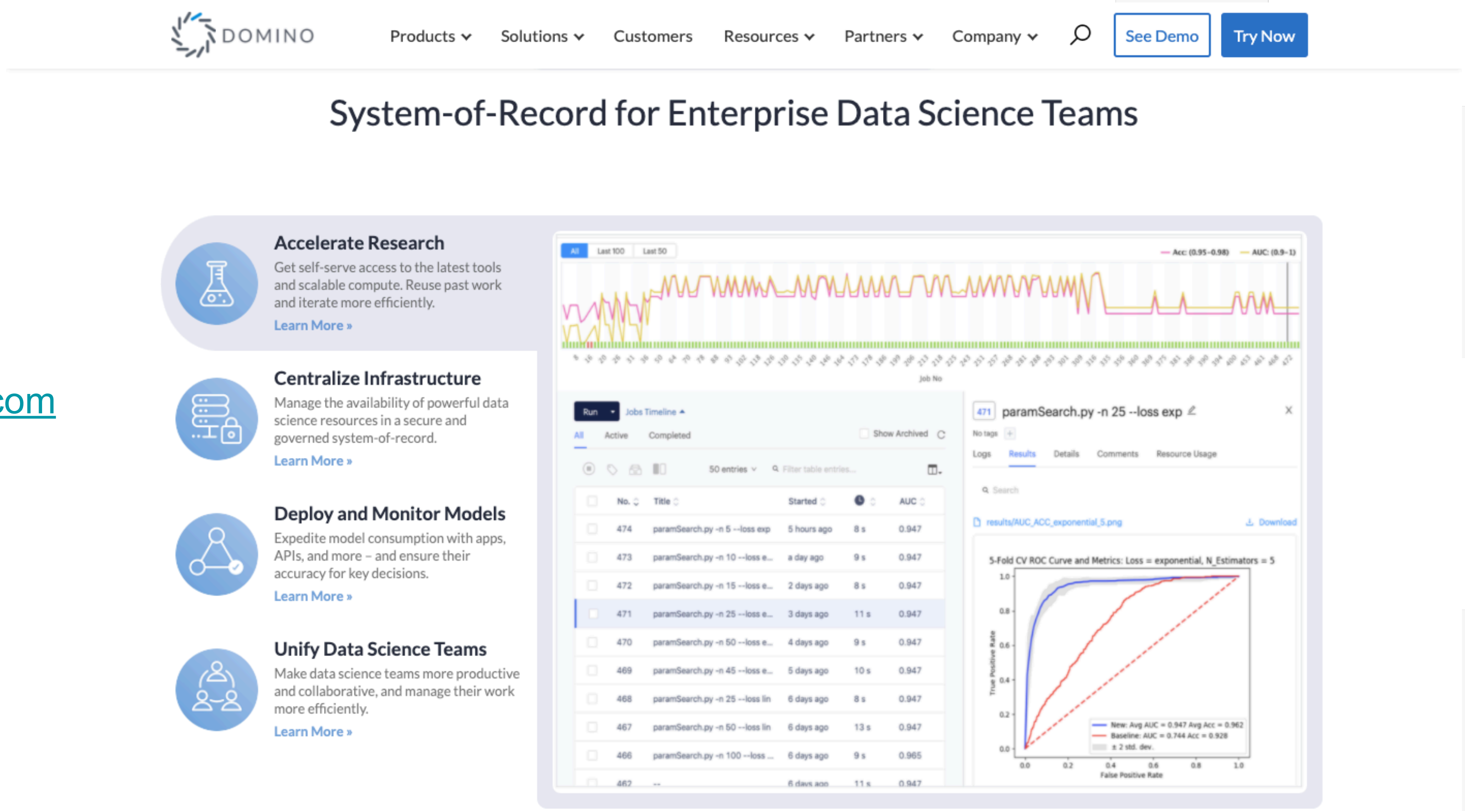

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Thanks for listening!

- ray.io
- raysummit.org
- dean@dominodatalab.com
- @deanwampler

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Title

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