Elyanah

Tom Walsh, NYC Data Science Academy

Elixir

- Scalable
  - Agents, Tasks, Servers
  - Lightweight Processes
- Fault Tolerant
  - Supervisors
- Functional
  - Immutable State
  - Pattern Matching
  - Data Flow with Pipes

“Thus, there’s a lot of energy devoted to creating the Next Big Thing; the framework that gives us what we love about Rails; the language that enables it like Ruby did while addressing their shortcomings and setting us up for the future.

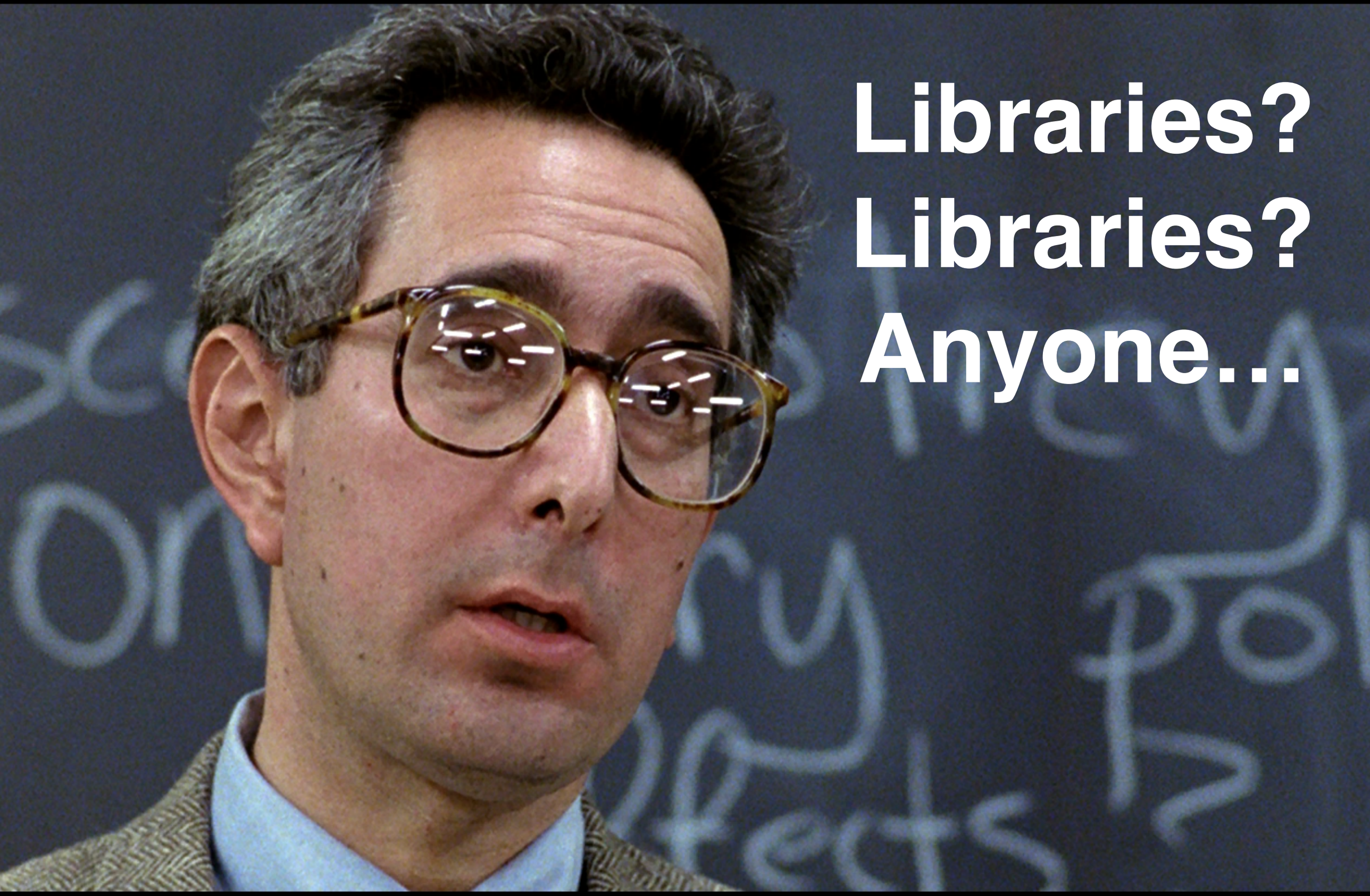
That framework is Phoenix and that language is Elixir.”

— Ken Miller

https://medium.com/infinite-red/phoenix-is-rails-5-f6d28e57395

```
def pmap(collection, func) do
  collection
  |> Enum.map(&(Task.async(fn -> func.(&1) end)))
  |> Enum.map(&Task.await/1)
end
```

Dave Thomas. “Programming Elixir 1.2”


Libraries?
Libraries?
Anyone...

“Elixir is only a few years old. On the one hand this means that there are not many quantitative libraries - but it also means you can get in on the ground floor.

How about being the guy who kicks off 'Elixir Pandas', a statistics or machine learning library?

In this environment a little can go a surprisingly long way.”

–John Orford

http://blog.johnorford.com/2015/11/01/x-reasons-to-use-elixir-in-finance/

Elyanah

A Very Early-Stage Machine Learning Library for Elixir

Neural Networks are Exciting…

…and I would like to understand how they work.

Design

- Process layers sequentially
- Process neurons within a layer in parallel
- Arbitrary numbers of layers, neurons.
- No skipping layers.
- Automatically convert factors
- Randomize initial weights intelligently
- Try not to **** up backpropagation

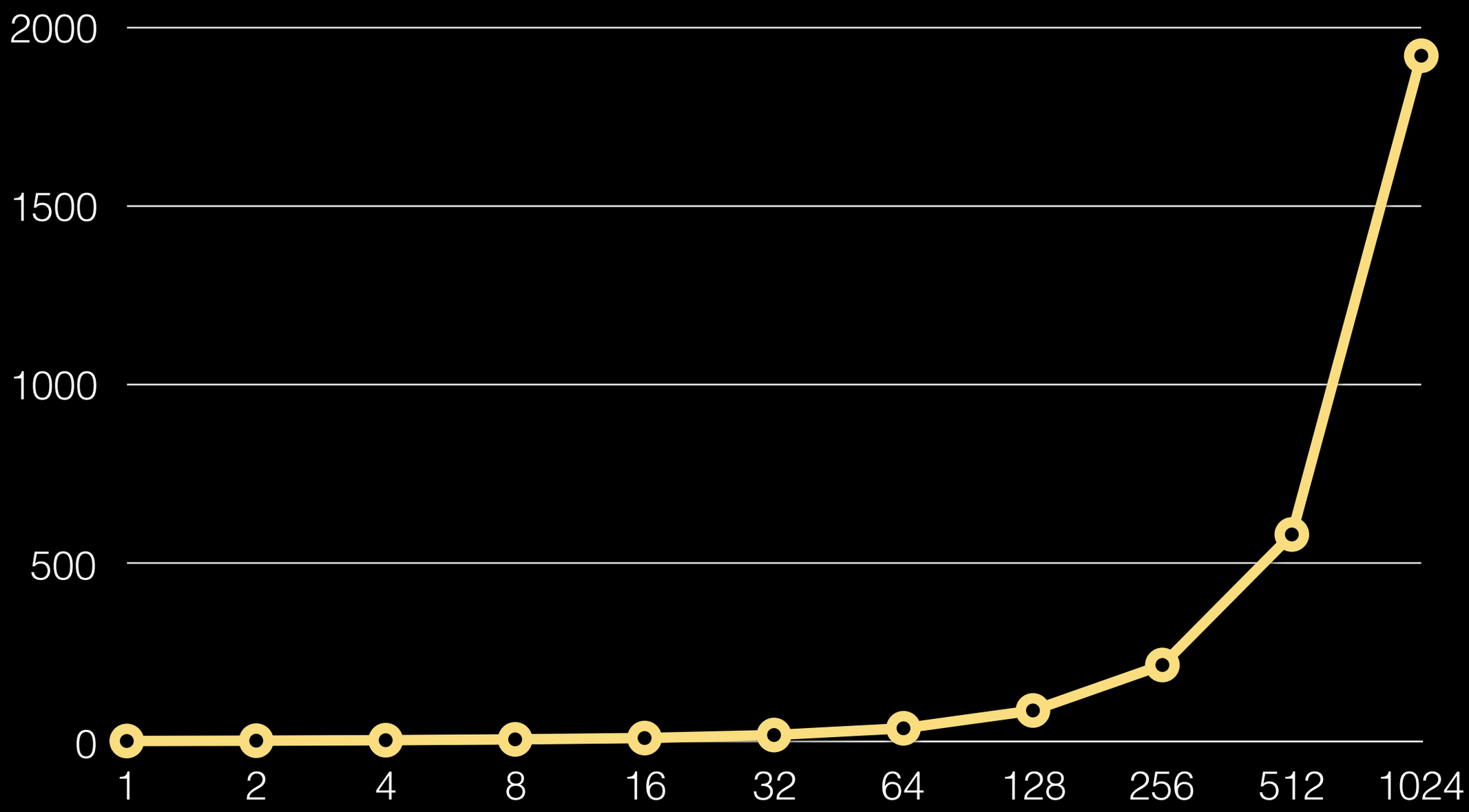
Usage

```
{:ok, net} = GenServer.start_link(Elyanah.NeuralNet, [5,5,1])
[prediction] = GenServer.call(net, {:predict, input})
GenServer.call(net, {:backprop, output, learning_rate})
```

Does it Work?

[1,0] vs. [0,1]	YES
random permutations of 10 variables	YES
Given a word, is the word count even or odd	NO
Predicting NBA shots	YES

Scalability?



Time in seconds to train 10000 observations of 10 variables as a function of the number of neurons in the single hidden layer on a 2014 Macbook Air.

Next Steps

- Code cleanup
- Supervision Tree
- Documentation
- Test cases
- Read more so I actually know what I'm doing
- Implement other statistics/ machine learning methods
- Use variables in back propagation that make sense to people

- Agents vs. servers?
- Escape from local minimums?
- Other activation functions?
- More flexible topology?
- Specifying initial weights?
- Inspection?
- Cloning and persistence?
- Search for params/topology?

Should I continue on the neural net or start building out other statistical tools?

What are the minimum requirements for a statistics/learning library to be useful?

Appendix

Pattern Matching & Tail Recursion

```
def dot([], []), do: 0
def dot([x|xx], [y|yy]) do
  x * y + dot(xx, yy)
end
```

```
def dot(x,y), do: _dot(x,y,0)
defp _dot([], [], acc), do: acc
defp _dot([x|xx], [y|yy], acc) do
  _dot(xx, yy, acc + x * y)
end
```

```
def dot(x,y), do: _dot(x,y,0)
defp _dot([], _, acc), do: acc
defp _dot(_, [], acc), do: acc
defp _dot([x|xx], [y|yy], acc) do
  _dot(xx, yy, acc + x * y)
end
```