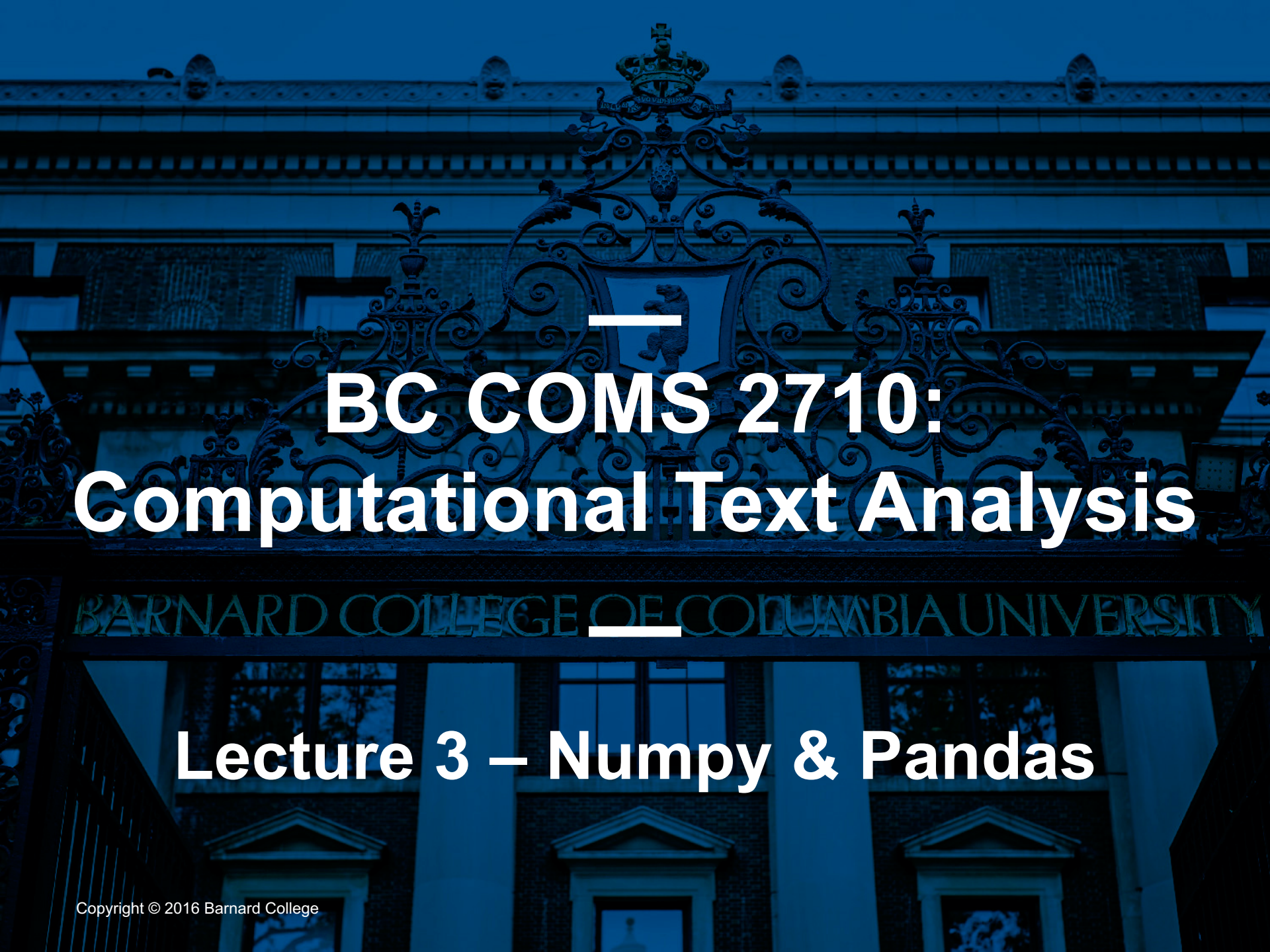


BC COMS 2710: Computational Text Analysis

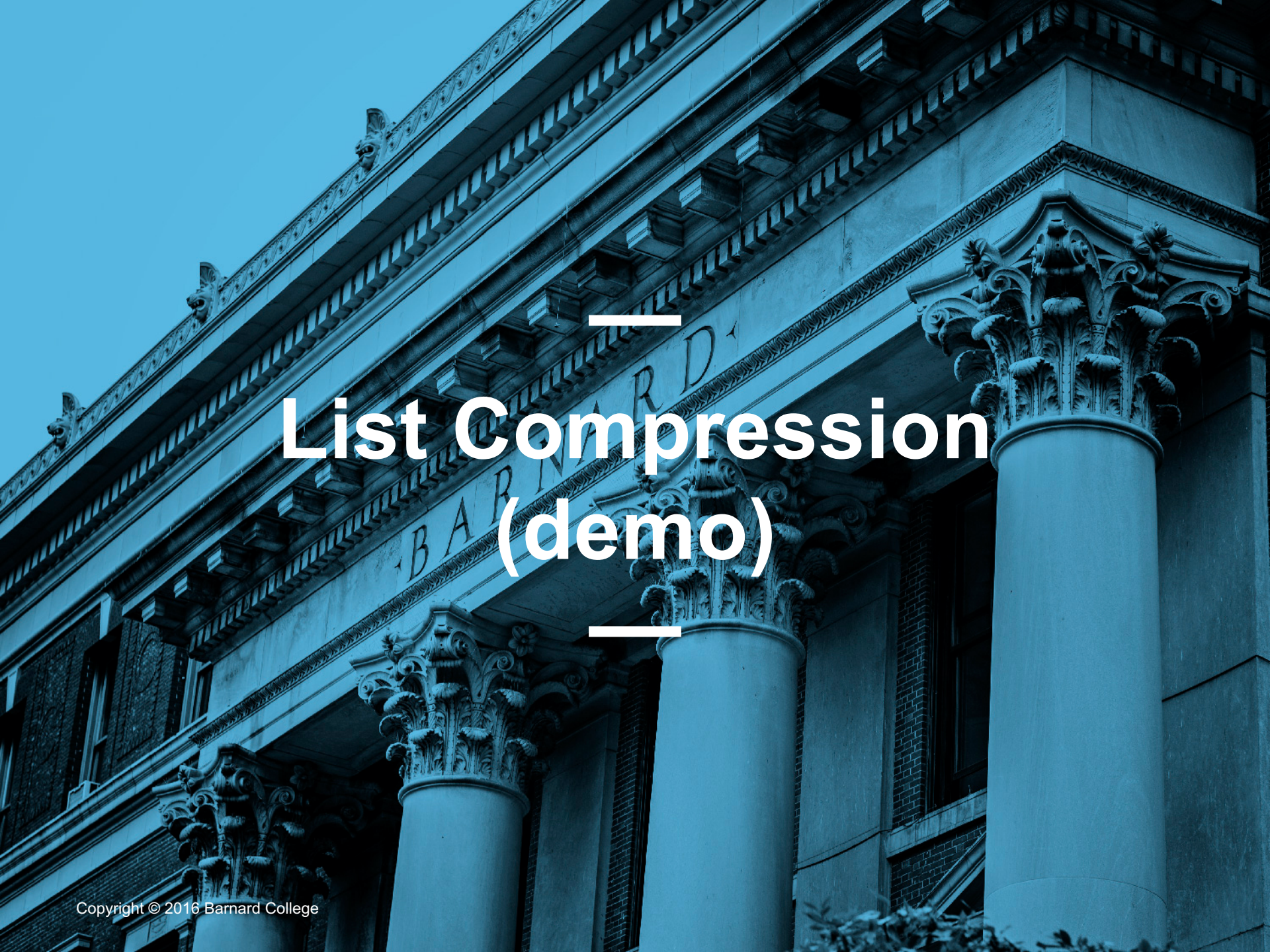
Lecture 3 – Numpy & Pandas

Office Hours

- Today (05/05): 5:00 - 6:00pm
- Weekly
  - Mondays: 1:00 – 3:30pm
  - Thursdays: 5:00 – 6:00pm
- Gauri will add hers soon

Announcements

- Make sure to sign up on Slack
- Friday 05/07: last day to add classes for Summer A



List Compression (demo)

Quantification

A core step in many analyses is translating social and cultural concepts (such as hate speech, rumor, or conversion) into measurable quantities.

Nguyen et. al.

Problem with python lists

- Python lists are slow
  - General purpose
  - Flexible types
- Numpy Arrays
  - Faster
  - Only single types
  - Can perform operations on them

Constructing Numpy Arrays

- np.array(sequence) – copy elements of sequence to an array
  - Type of elements is deduced automatically
  - Nested sequences are transformed into N-dimensional arrays
- np.zeros(shape) , np.ones(shape), np.full(shape, val) – array of zeros, ones, or val with fixed size
  - shape is a tuple elements of sequence to an array
- np.empty(shape) - array of arbitrary elements with fixed shape
- np.zeros_like(array) , np.ones_like(array), np.full_like(array) – copy shape from other array

Slides from Jorge Mendez, UPenn

Constructing Numpy Arrays

- np.arange(start, stop, step) – copy elements of sequence to an array

- np.linspace(start, stop, number_of_elements) – array of evenly spaced numbers over a specified interval

Applying Operations to Numpy arrays

Apply operations to each element:

- Arithmetic operations (addition, subtraction, multiplication, division)
- Conditionals

Unary and universal operations

- .sum() – computes sum of array
- .max() – finds max value of array
- .min() – finds min value of array
- .argmax() – finds index of the max value of array
- .argmin() – finds index of the min value of array

There's much more to NumPy

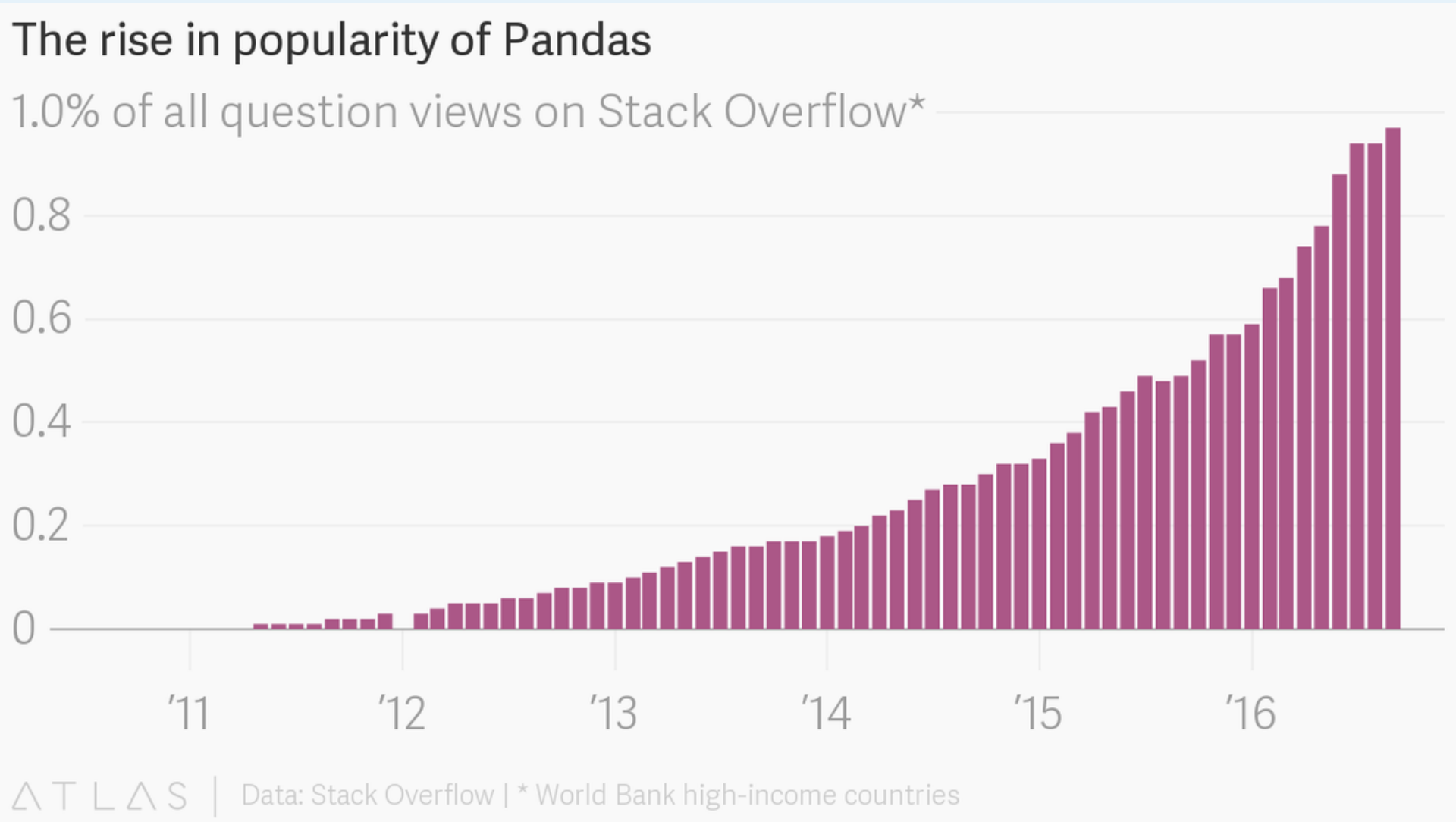
- This barely covers NumPy's quickstart tutorial!
- It's impossible to learn all of NumPy's functionality
- So how do you know when NumPy has the function you need?
  - Usually, if you are looping through an array, you can vectorize your code
  - If fancy indexing is not enough, then there might be a NumPy function for what you need

More Numpy References

- **Aurélien Geron** wrote an excellent notebook going through numpy:
  - https://nbviewer.jupyter.org/github/ageron/handson-ml2/blob/master/tools_numpy.ipynb

Pandas

Pandas popularitty



What is Pandas

- A very powerful package of Python for manipulating tables
- Built on top of numpy, so is efficient
- Save you a lot of effort from writing lower python code for manipulating, extracting, and deriving tables related information
- Easy visualization with Matplotlib

Slide from **Han-Wei Shen**

Purpose of Panadas

- Optimized for wide variety of data analysis operations
  - I/O to/from formatted files and databases
  - Missing data handling
  - Slicing, indexing, reshaping, adding columns
  - Powerful grouping for aggregating and transforming data sets
  - Merging and joining data sets
  - Time-series functionality
- Applied in finance, neuroscience, economics, statistics, advertising, web analytics, and more.

Data Structures in Pandas

- Series 1-dimensional
  - Like numpy array's but more advanced
- DataFrame 2-dimensional

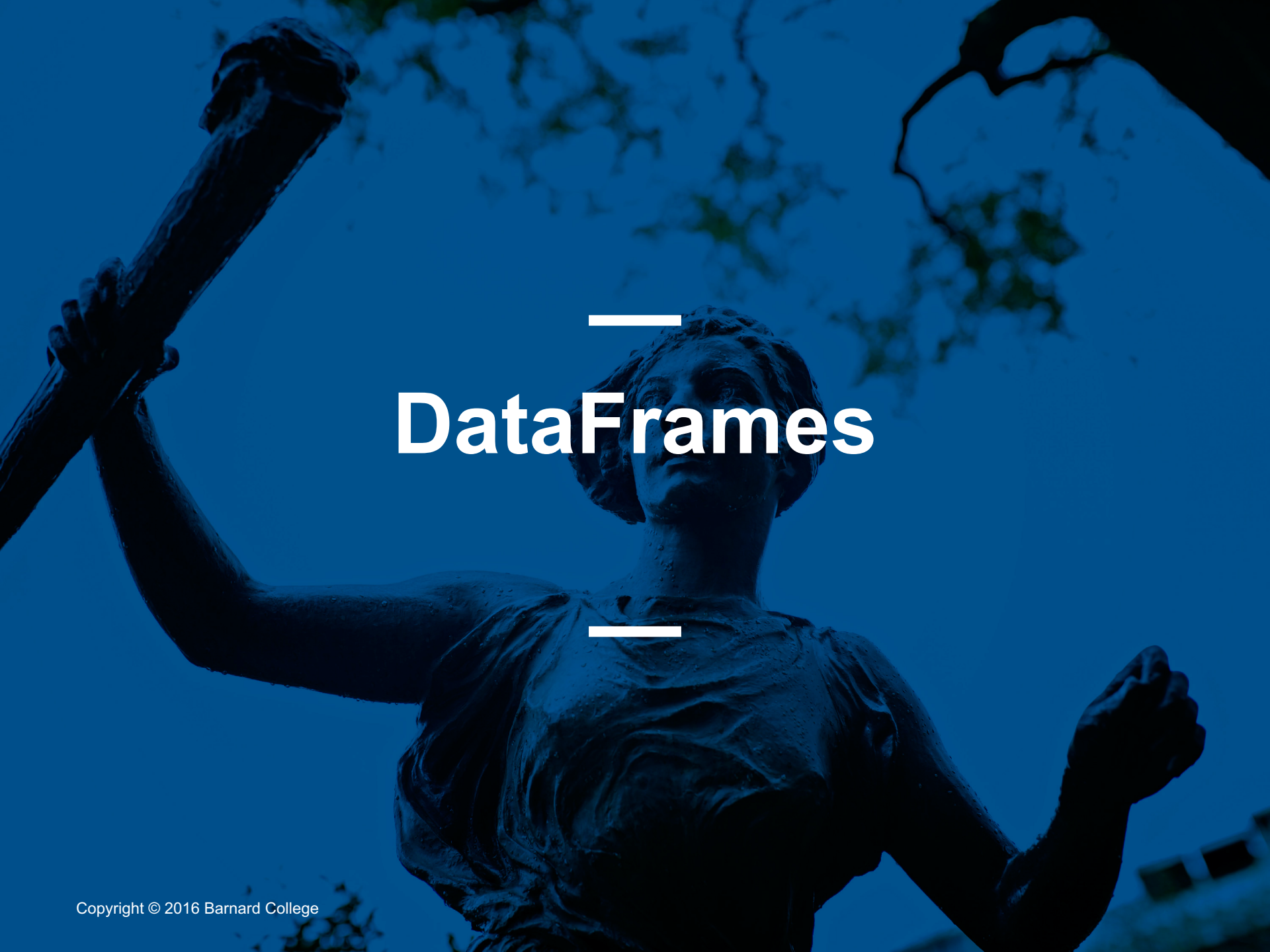
Series

- One-dimensional array
- Possibly heterogeneous type (although usually not)
- Each element has a label referred to as index
- Missing values are represented as NaN
- May be MultiIndexed hierarchically

Constructing Series

- pd.Series(ndarray, index=None) – series from array-like collection in same order
  - ndarray must be 1-dimensional
  - If index is provided, must be same length as ndarray
  - If index is not provided, will be 0, ..., len(ndarray) – 1

- pd.Series(dic, index=None) – series from dictionary
  - If index is provided, it gives the order over dict
  - If index contains keys not in dict, treated as missing value
  - If index does not contain some key in dict, it is discarded
  - If index is not provided, order will be insertion order into dict
- pd.Series(scalar, index) – repeated scalar value
  - Index is requried



DataFrames

DataFrame

- 2-dimensional labeled structure
- Possibly heterogeneous type (common across columns)
- Intuition: spreadsheet or SQL table
  - Each row is a record/individual
  - Each column is an attribute
- Also: like a dictionary of Series objects
  - Keys are column names
  - Values are Series

Reading and Writing DataFrames from files

Format Type	Data Description	Reader	Writer
text	CSV	read_csv	to_csv
text	Fixed-Width Text File	read_fwf	
text	JSON	read_json	to_json
text	HTML	read_html	to_html
text	Local clipboard	read_clipboard	to_clipboard
binary	MS Excel	read_excel	to_excel

More Pandas References

- **Aurélien Geron** wrote an excellent notebook going through pandas:
  - https://nbviewer.jupyter.org/github/ageron/handson-ml2/blob/master/tools_pandas.ipynb

- BabyPandas online textbook:
  - https://eldridgejm.github.io/dive_into_data_science/02-data_sets/dataframes.html