

Welcome to Rice University Financial Technology Bootcamp

GitLab: Do you have access?

Slack: Open Desktop App & Add Photo!



First Assignment

1. Navigate to www.bootcampspot.com
2. Sign in
3. Click Sessions
4. Find Today's Date
5. Mark Your Attendance
6. Close your laptop

By the end of this session, you will:

- Come to know your classmates as the community that you will rely on for collaborative learning.
- Know the staff who will be providing holistic support throughout the program.
- Understand the minimum requirements in order to successfully complete this boot camp.
- Be able to list ways to get help and support at your moments of need.



David Vassar, PhD

Assistant Dean for Professional and
Executive Programs
Rice University

dvassar@rice.edu

Kara Nichols

Student Success Manager

knichols@bootcampspot.com

Schedule time to meet virtually:
<https://calendly.com/knichols-5/1-1-with-your-ssm>

Monday - Thursday 10am-7pm
Saturdays for events and class visits



Kevin Heaney

Teaching Assistant

- Member of the Chicago Mercantile Exchange
- Graduate of Washington University in St. Louis Data Analytics Bootcamp
- Enjoys running and reading



Juan Zambrano

Teaching Assistant

- Sr. AI/ML Software Engineer at PFS group
- Solution Developer at Neetek Systems Integration
- Graduate of the University of Texas at Austin.
- I like food, sugar gliders, and academics. Hobbies and freelance work consist of Real-estate and application development, along with quantitative trading and investing.
- This is my 2nd FinTech cohort as a TA .



Cam Kirkland

Instructor

- Lead Curriculum Architect for Enterprise Products at Trilogy Education Services
- Instructor for Financial Technology, Web Development, and Data Analytics
- Formerly an electrochemist
- Taco Fanatic. (I live next to Tacos a Go-Go)
- 10th cohort of instruction



Your turn!

In 30 seconds or less, please share:

Name

Background (Career, Education, Interests)

One **Fun Fact** about yourself

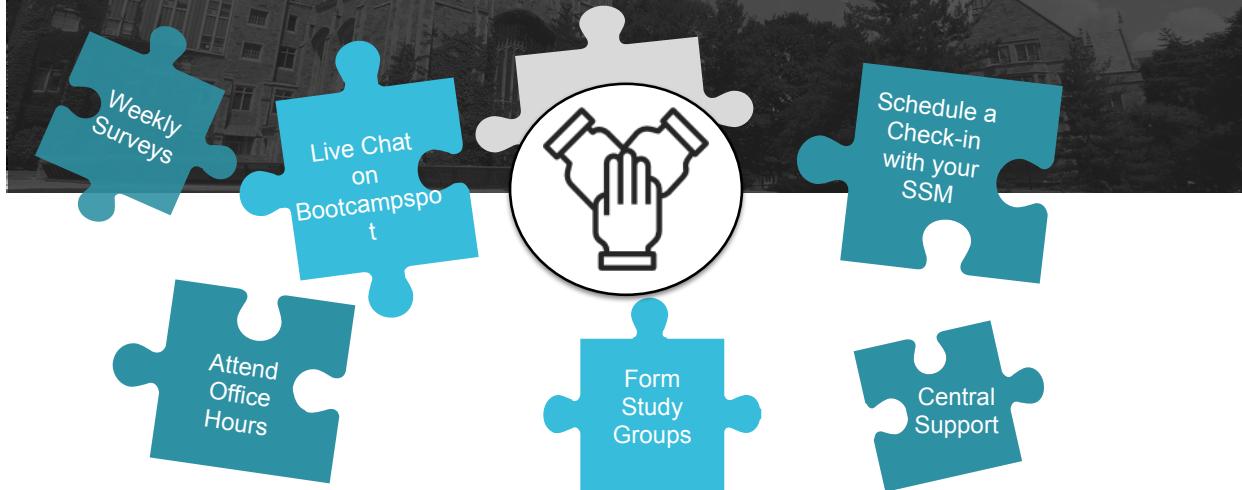


**YOUR
CAREER SERVICES
TEAM**

YOU

SUPPORT STRATEGIES

You are responsible for your **success**, but you're not alone!



Our Classroom Values

We Never Stop Improving

We lend an ear to both praise and feedback to deliver our best work.
This process is a journey and not a destination.

We Bring a Can-Do Attitude

We confront challenges with enthusiasm and figure things out. We value effort, Commitment, learning, and an attitude toward growth.

We Only Succeed Together

Teamwork is critical to our success, and we place a tremendous value on how we work together across the entire cohort.

We Respect the Rights, Differences, and Dignity of Others

We want to create a learning space where people can bring their full selves. In order to do this we must all respect the diversity of our experiences and how it contributes to our learning.

Requirements to Achieve a Certificate:

- Miss no more than 8 classes
- Have no more than 2 incomplete/unsubmitted homeworks
- 100% Participation in group projects
- Add/Drop Period (deadline 10:00 am 1 week from start date)

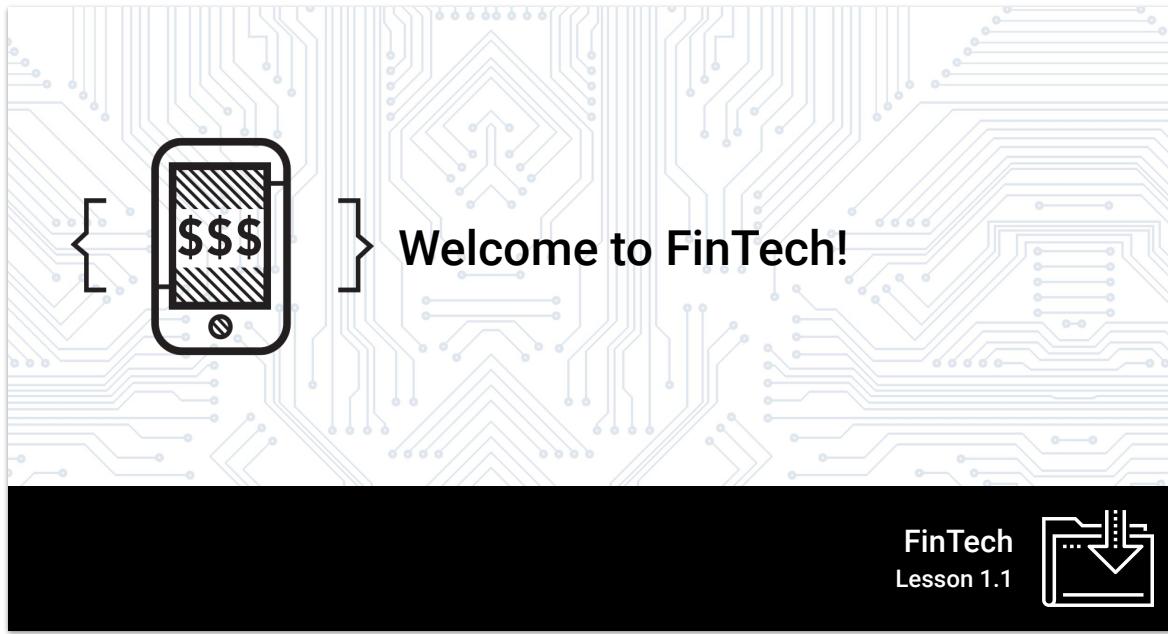
(Refer to student policies in Gitlab)

Let's Review What We've Covered So Far:

- Come to know your classmates as the community that you will rely on for collaborative learning.
- Know the staff who will be providing holistic support throughout the program.
- Understand the minimum requirements in order to successfully complete this bootcamp.
- Be able to list ways to get help and support at your moments of need.

Break

See you back
in a few!





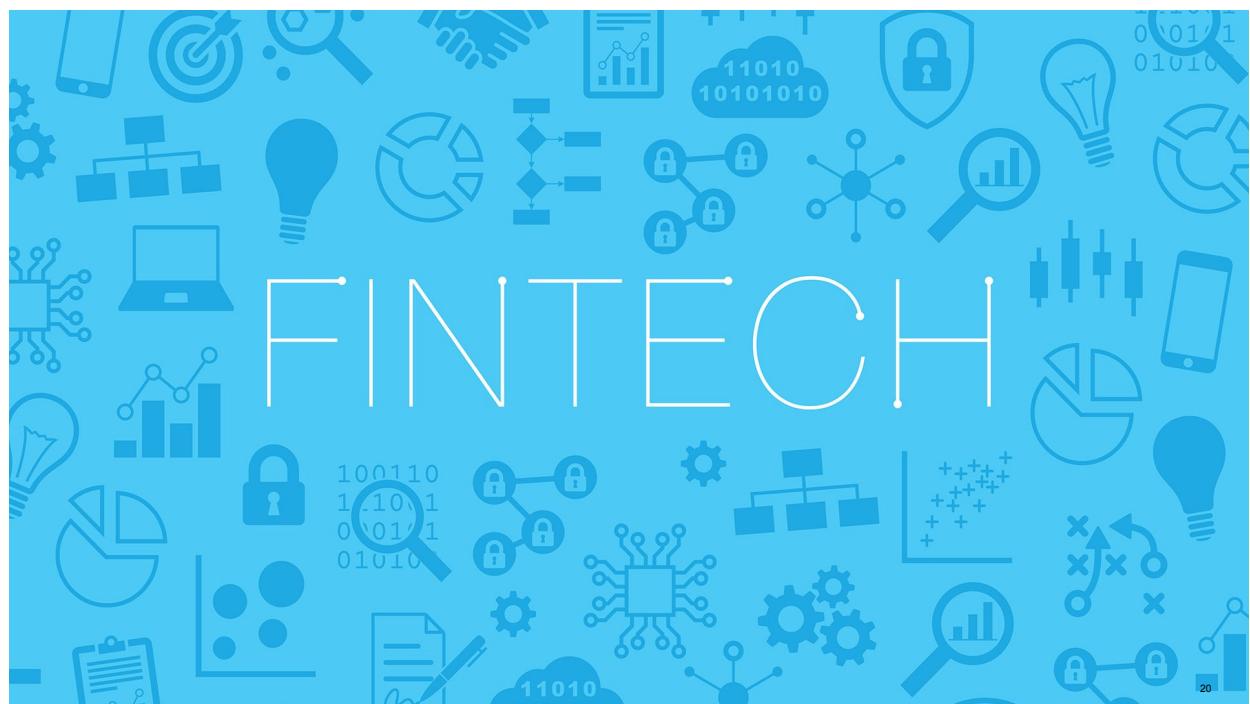
Class Objectives

By the end of today's class, you will:

-  Get to know the instructional team as well as each other.
-  Become familiar with the course format and requirements for certification.
-  Review the course topics and agenda.
-  Be able to explain what FinTech is.
-  Review the completion and submission guidelines for the Unit 1 homework assignment.

Defining FinTech

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What Is FinTech?

The broader FinTech category can be segmented into four variants.

Origin	Technology	Infrastructure providers seeking to help financial institutions digitize and modernize their technology stacks. Examples: FNZ, Marqeta, Onfido	Large technology ecosystems using financial services to strengthen relationships with users. Examples: Apple, Ant Financial, Tencent
	Financial Services	New entrants, start-ups, and attackers seeking to enter financial services using new technologies. Examples: SoFi, TransferWise, LendingClub	Incumbent financial institutions making significant investments in technology to lift their game. Examples: Wells Fargo, Ping An
		Low (small scale)	High (large scale)
		Scale	

Source: McKinsey analysis

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But what exactly *is* FinTech?



FinTech is the combination of finance and technology. More specifically, it describes a **financial services industry** that has been disrupted by **technological innovation** that competes with traditional **financial methods** and **improves activities and inefficiencies** in finance.



Activity: FinTech Group Discussion

In this activity, you will reflect on what FinTech means to you.

(Instructions sent via Slack.)

Suggested Time:
5 Minutes

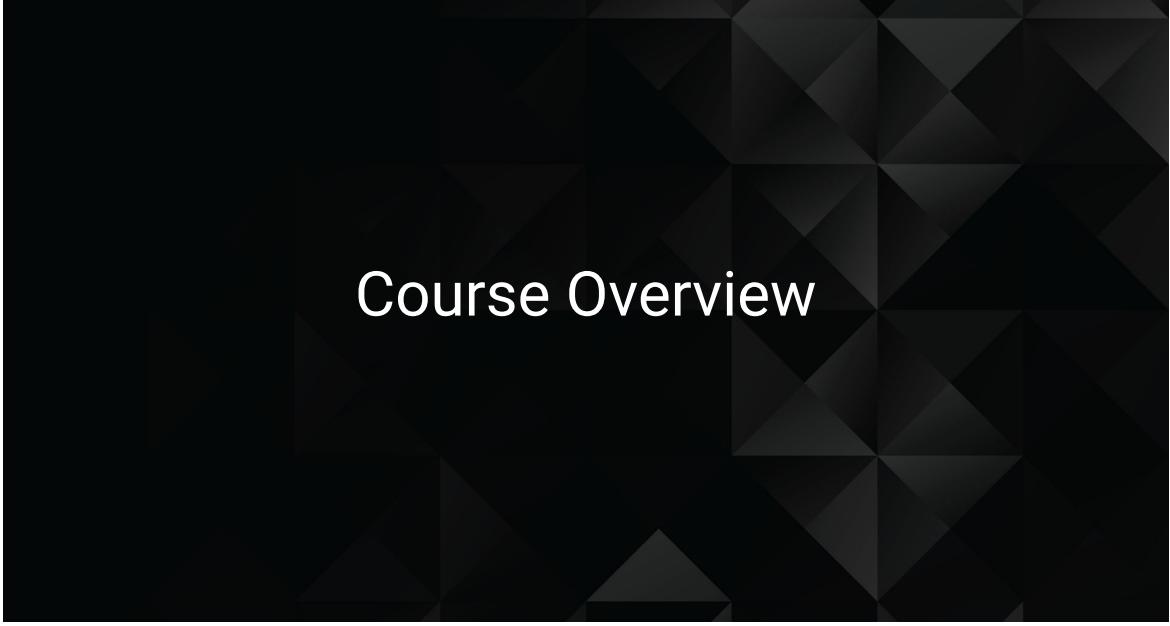


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Time's Up! Let's Review.

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Course Overview

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Curriculum Overview

Intro to FinTech

First, you'll learn about the fundamental priorities of investment banks, traders, insurance agencies, and other players in the financial industry. You will also learn about the command line and GitHub to prepare for future programming assignments.

Python and Financial Programming

Next, you'll learn Python programming, focusing in depth on the core libraries relevant to finance work. You will use APIs like Quandl to add live financial data feeds to your software projects. You'll also use a variety of analytic tools to extract insights and create reports.

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Curriculum Overview

Algorithms, Statistics, and Machine Learning

You will learn a variety of core algorithms, models, and forecasting tools, including Monte Carlo simulations, risk-data aggregation, portfolio theory, and regression. You'll draw on this background as you apply machine learning concepts to financial challenges.

Advanced Topics: Big Data and Blockchain

The course will end with deep coverage of the big data and blockchain toolchains. You will use Python to complete challenges that involve building and using these toolchains for financial and regulatory benefit.

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Curriculum Breakdown by Week

Unit 1: Intro to FinTech

1. Intro to FinTech and Finance

Units 2–7: Python for Finance Deep Dive

2. Python Basics
3. Python and Pandas + Review Day
4. Pandas + Review Day
5. APIs
6. Data Visualization
7. SQL

Units 8–9: Project Work

8. Project 1
9. Project 1 continued

Units 10–15: Applied Machine Learning

10. Time Series Analysis
11. Classification
12. Natural Language Processing
13. AWS and Cloud ML
14. Deep Learning and Robo Advisors
15. Algorithmic Trading

Units 16–17: Project Work

16. Project 2
17. Project 2 continued

Units 18–22: Blockchain Deep Dive

18. Intro to Blockchain
19. Interacting with Blockchains in Python
20. Intro to Solidity & Smart Contracts
21. Advanced Solidity & Smart Contracts
22. Blockchain Application Development

Units 23–24: Project Work

23. Project 3
24. Project 3 continued

Core Program Modules

Python

Applied ML and AI

Blockchain / Cryptocurrency

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Curriculum at a Glance

Week 1: You will be introduced to the world of FinTech and discuss the current financial landscape.

Week 1

Weeks 2–7

Weeks 2–7: You will learn the basics of Python and how to use additional libraries and tools such as Pandas, APIs, Plotly, and SQL databases, in the context of financial analysis.

Weeks 2–7

Weeks 8–9: You are tasked with your first project.

Weeks 8–9

Weeks 10–15: Companies are becoming more and more data-driven in their decision making. Therefore, through machine learning, you will need to learn how to not only interpret and create financial models, but also how to automate the execution of such models. Topics include algorithmic trading, robo-advisory, time series analysis, risk management, and Cloud ML technologies.

Weeks 10–15

Weeks 16–17: You are tasked with your second project.

Weeks 16–17

Weeks 18–22: With its benefits of security, speed, and decentralized peer-to-peer validation, blockchain technology has already become more efficient than traditional finance in the context of transactions and third-party validation. You will learn blockchain fundamentals, smart contracts using Solidity, and how to develop blockchain applications on the popular Ethereum blockchain network.

Weeks 18–22

Weeks 23–24: You are tasked with your final project.

Weeks 23–24

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Hard Skills + Core Knowledge = Real Jobs

Skills/Technologies Covered

- Time Series Analysis
- Financial Ratios / Analysis
- Python Programming
- API Interactions
- Pandas
- NumPy / SciPy
- Pyfin
- Quant DSL
- SQL
- Monte Carlo Simulations
- Forecasting
- Modern Portfolio Theory
- Machine Learning
- Big Data
- Blockchain / Cryptocurrency

Relevant Jobs

- Business Analyst
- Financial Analyst
- Data Analyst
- Data Scientist
- Quantitative Trader
- Systems Business Analyst
- FinTech Regulatory Associate
- Software Developer
- Financial Manager
- Business Intelligence Analyst
- Cryptocurrency Expert
- Blockchain Developer

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Sample Homework Assignments

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Sample Assignment: Risky Business (APIs and Statistics)

You will learn to create *live* applications that draw stock data using the financial APIs to power Jupyter notebooks to analyze stock movement.

The diagram illustrates the workflow for the assignment:

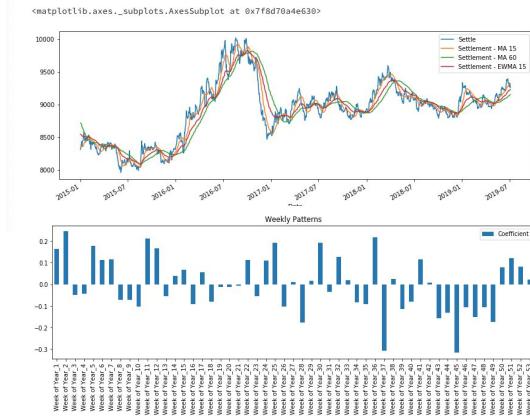
- Stock Quote API:** Shows a screenshot of the Apple Inc. (AAPL) stock quote on NasdaqGS. It includes fields like Previous Close (139.52), Open (138.92), Bid (139.00 x 500), Ask (139.12 x 3000), Day's Range (138.82 - 139.80), 52 Week Range (89.47 - 140.28), and Volume (16,641,812). A red box highlights the "Summary" tab.
- Quandl:** Represented by the Quandl logo.
- Jupyter Notebook Simulation:** Shows a screenshot of a Jupyter notebook cell with Python code. The code performs Monte Carlo simulations on AAPL stock price data. It includes imports for `pandas` and `numpy`, generates random daily returns, simulates 1000 price paths, and plots the results. The output shows a 3D surface plot of simulated price trajectories over 252 trading days.

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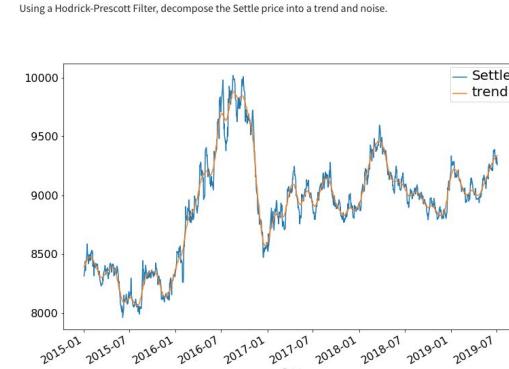
Sample Assignment: Stock Forecasting (Python & Time Series Analysis)

You will learn to create **predictive models** for stock prices using time series analysis and disparate variables.

Return Forecasting: MA/EWMA Smoothing of Futures Prices



Return Forecasting: Decomposition Using a Hodrick-Prescott Filter



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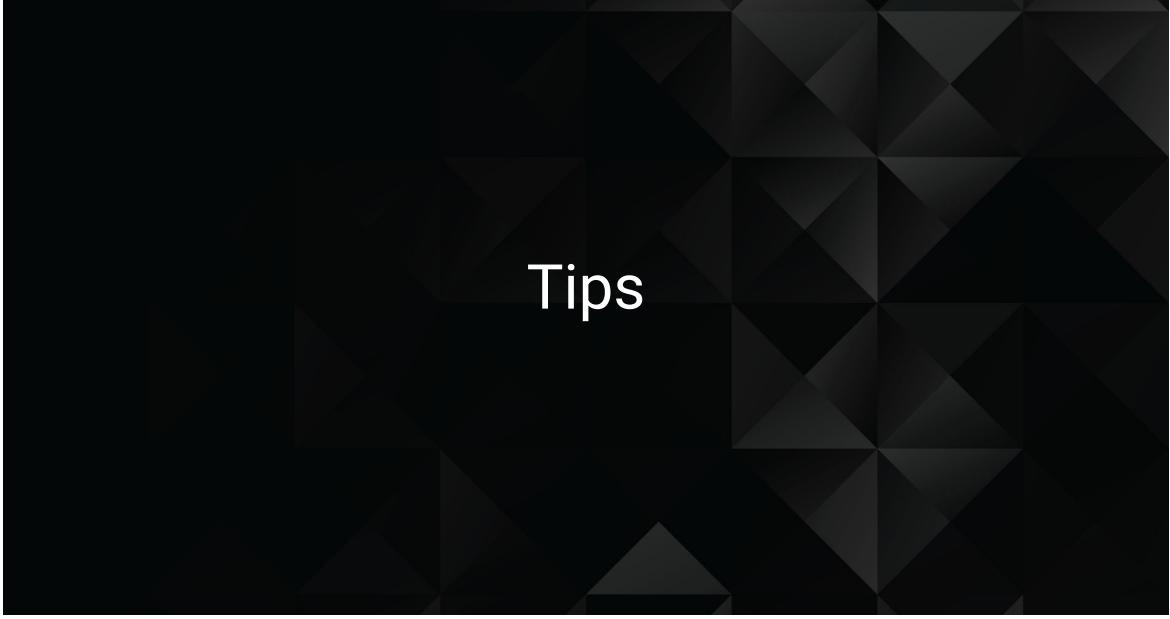
Sample Assignment: Crypto Sentiment (Machine Learning)

Throughout the course, you will learn the basics behind the most common **machine learning techniques** (linear regression, logistic regression, KNN, k-means clustering, etc.) and how to apply these algorithms to classic challenges in the financial services sector, e.g., applying natural language processing to analyze sentiment scores for cryptocurrency news.

	Compound	Negative	Neutral	Positive	text
0	0.0516	0.900	0.036	0.064	Cryptocurrency exchange Binance has resumed tr...
1	0.3818	0.943	0.000	0.057	Bitcoin is now trading at around \$8,130, up a ...
2	-0.2263	0.888	0.065	0.047	Binance has vowed to raise the quality of its ...
3	0.3612	0.937	0.000	0.063	A new payment network called Flexa is launchin...
4	-0.6486	0.897	0.103	0.000	If you thought that the theft of 7,000 bitcoin...

Binance NER
Cryptocurrency exchange **Binance PERSON** has resumed trading activity. Users can now cancel open orders, deposit crypto assets into their **Binance GPE** account, and of course buy and sell cryptocurrencies. You can withdraw crypto assets to an external wallet just yet, but... (+1191 chars) Bitcoin is now trading at around \$8,130 **MONEY** over the period. up a whopping **60.94 percent PERCENT** over **the past month DATE**, with the price surging \$ **3,086.14 MONEY** over the period.
The cryptocurrency's meteoric rise is reminiscent of its rocketing growth in **the latter half of 2017 DATE**, when prices reached... (+4311 chars) Binance has vowed to raise the quality of its security in the aftermath of a hack that saw thieves make off with over \$40 million **MONEY** in **Bitcoin GPE** from the exchange.
The company — which is widely believed to operate the world's largest crypto exchange based on... (+2269 chars) A new payment network called **Flexa ORG** is launching **today DATE** that'll let you spend cryptocurrencies in physical stores. The technology currently supports bitcoin, ether, bitcoin cash, and the gemini dollar, and it'll work at retailers including **GameStop ORG**, **Nordstrom NORP**, ... (+1743 chars) If you thought that the theft of 7,000 **CARDINAL** bitcoins from one of the world's biggest crypto exchanges would stop **Bitcoin GPE**'s price in its tracks, you were wrong.
On **Thursday DATE**, the price of **Bitcoin GPE** went above \$ **6,000 MONEY** for the **first ORDINAL** time since **November last year DATE**. At... (+1729 chars) Quadratic.io, a startup founded by some of the folks behind the once-secretive bitcoin mining operation 21EG, has raised \$15 million **MONEY** in a Series A round that will fund the development of a supercomputer designed for autonomous systems.
The round was led by... (+3424 chars) A **Europol PERSON** -led police operation has arrested **three CARDINAL** people who allegedly ran the Wall Street Market, supposedly the world's **second ORDINAL** -largest "dark web" marketplace. Authorities also seized the site's servers and more than €50,000 **MONEY** (around \$615,000 **MONEY**)

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Tips

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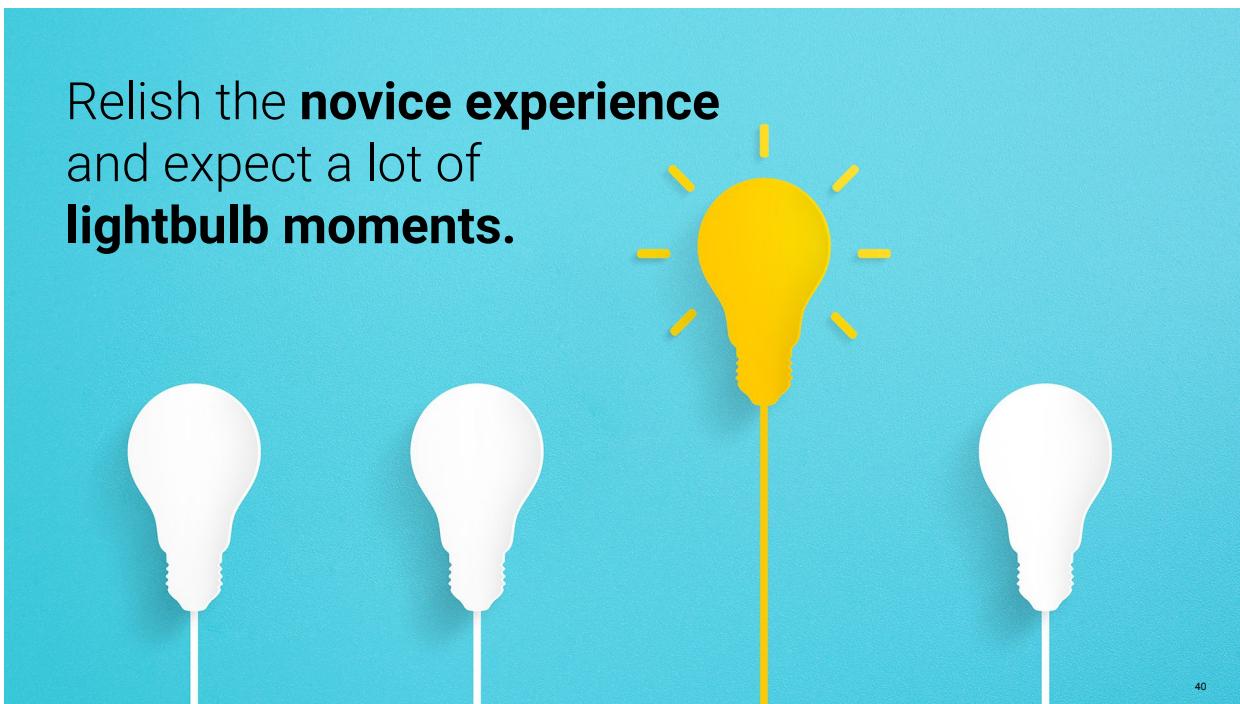
Embrace your
inner toddler.

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Brace yourself
for **doubt**,
challenge,
and **confusion**.

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Relish the **novice experience**
and expect a lot of
lightbulb moments.

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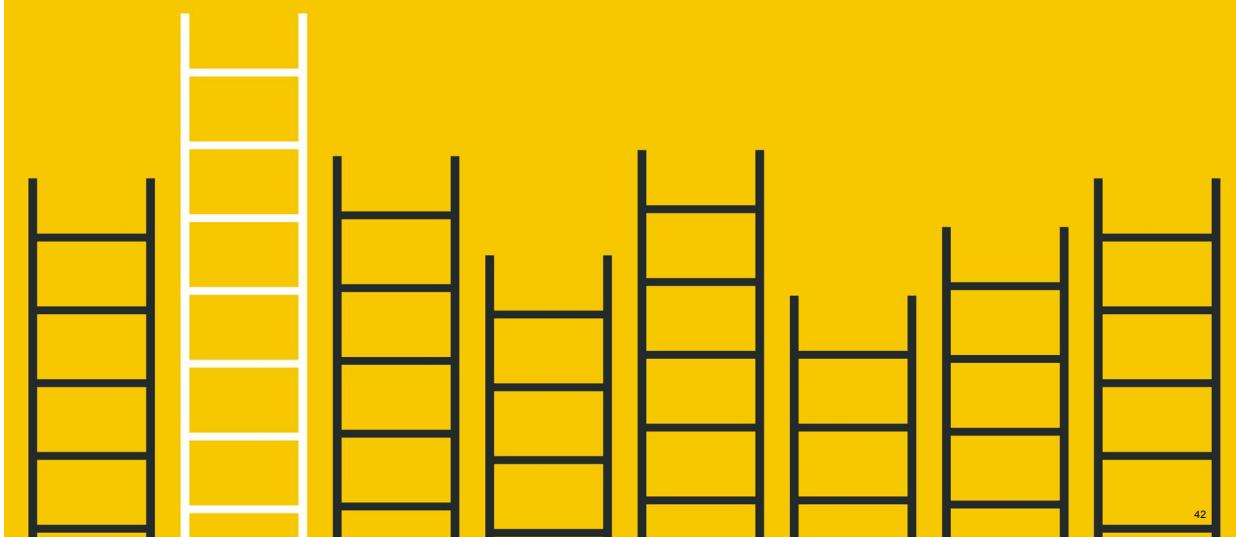
Form a **community** with your classmates.

You and your classmates are in this process together. Use each other for help!

You all bring value to the table.
Don't be afraid to speak up!



There is no shortcut.
You've got to **put in the hours!**



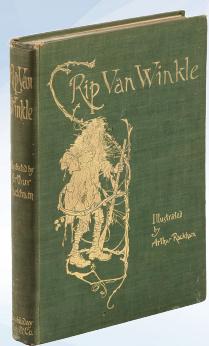


Celebrate
your successes!



What was the finance world like in 1999?

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Activity: Rip Van Winkle

Rip Van Winkle is the story of a man who fell asleep right before the events of the American Revolution. He woke up 20 years later to find the world completely changed.

In this thought experiment, you will imagine what it would be like if Rip Van Winkle was a financial analyst who fell asleep in 1999 and woke up 20 years later.

Suggested Time:
10 Minutes



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Activity Instructions: Rip Van Winkle

Apply the Rip Van Winkle story to FinTech by imagining if a financial analyst fell asleep in the year 1999 and woke up today. What would he or she find most surprising about the current finance world?



Define areas of finance that have been deeply affected by technology.



Name specific companies, products, or innovations that would be surprising to a financial analyst from 1999.

Suggested Time: 10 Minutes



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Time's Up! Let's Review.



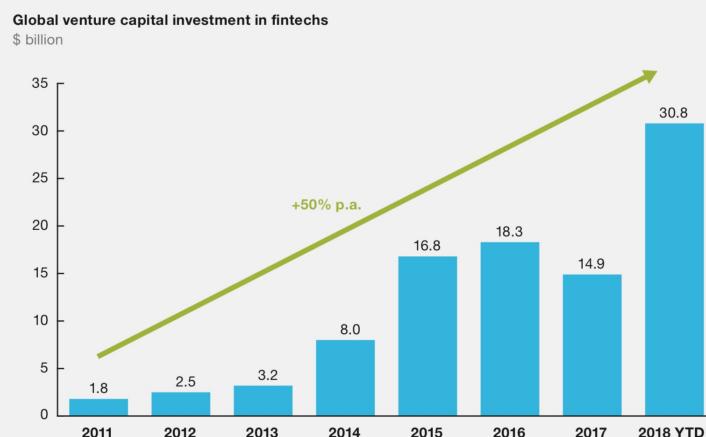
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The Rise of FinTech

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Global FinTech Investment Growth

FinTech investment has shown dramatic growth in recent years.



Source: CB Insights; McKinsey analysis

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Why is FinTech such a **hot** field of study these days?

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The Driving Forces of FinTech

FinTech is driven by the same trends that dominate software and consumer technology.

Driving Technologies

Artificial Intelligence

Blockchain

Mobile Technology

Machine Learning

Cryptocurrency

Cloud / Dev Ops

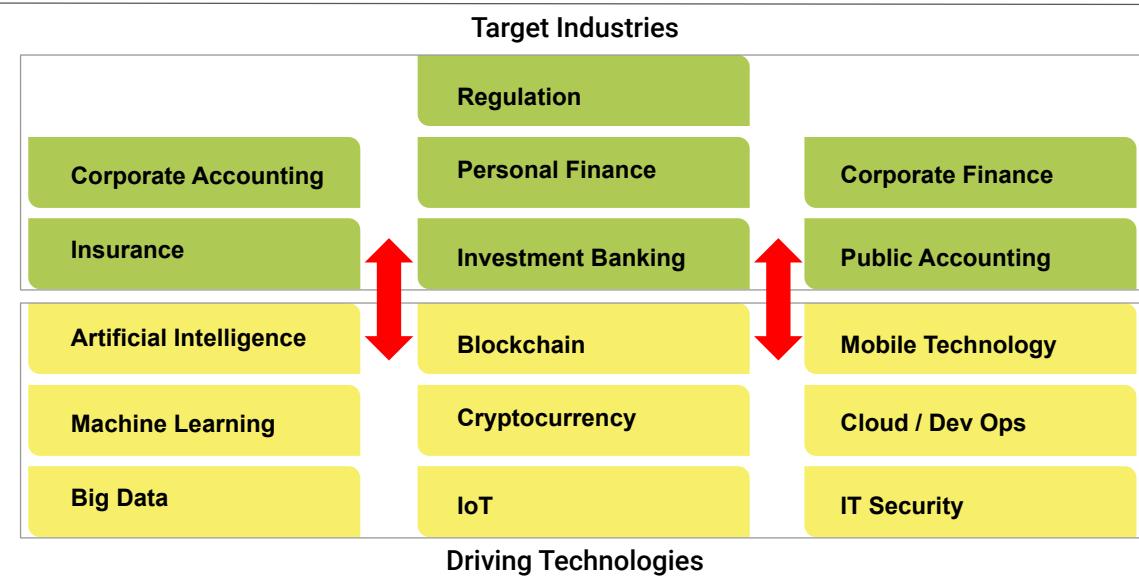
Big Data

IoT

IT Security

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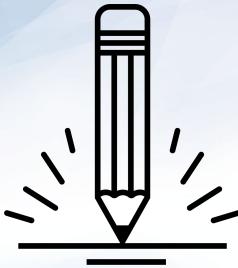
The Driving Forces of FinTech



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FinTech Thought Experiments

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Activity: Alpacalypse Now

In this activity, you will work in groups to define and articulate the challenges faced by the Altruistic Alpacas charity. You will then pitch a solution to Altruistic Alpacas based on your group's brainstorm.

Suggested Time:
15 Minutes



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Activity: Alpacalypse Now

The Client:

Altruistic Alpacas is a charitable organization based in Zanesville, Ohio.

Its mission is to provide alpacas to impoverished areas of the world by empowering people to donate them directly to farmers.

Alpacas provide fiber (wool/yarn), milk, and leather, and are a phenomenal way to provide relief to areas of the world that need it.

In the past few months, Altruistic Alpacas has generated a lot of buzz, and donations have started to pour in.



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Activity: Alpacalypse Now

The Situation:

Altruistic Alpacas has a great mission and lots of buzz, but no plan to execute.

While they received a lot of initial donations, they had no clear system for sending alpacas to the correct locations. Donations are being returned to their office in Zanesville! Alpacas are literally piling up in the office, spitting on the interns, and eating all the donuts!

Additionally, donors have no way of knowing if their alpaca was actually delivered. Recipients have no clear global marketplace to sell alpaca wool, and Altruistic Alpacas has not established a system for monitoring the impact of its work.

Altruistic Alpacas is on the brink of collapse!



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Activity: Alpacalypse Now

Your Mission:

Altruistic Alpacas has asked your group to analyze their key problem areas and offer potential solutions to their problems.

In your groups, you will:

- Discuss the 5 key problems facing Altruistic Alpacas (on next slide).
- Brainstorm potential solutions.
- Give a quick pitch of your analysis and solutions to Altruistic Alpacas (aka, the rest of the class).

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Activity: Alpacalypse Now

The Need:

Altruistic Alpacas is looking to solve **5** key problems that currently jeopardize their organization.

1. Where should the alpacas be sent in order to do the most good?
2. How does the charity purchase alpacas with donation money? What would be different if it purchased the animals near the local economies?
3. How can the charity ensure that the alpacas arrived at the correct destination?
4. Where can the recipients of alpacas sell alpaca wool?
5. Did the alpaca donations actually have a positive impact?

With your group, analyze these 5 key areas and identify the technical and financial challenges associated with each problem. Be ready to pitch potential solutions to Altruistic Alpacas!

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Time's Up! Let's Review.

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Review Alpacalypse Now

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Analyze the Need
(Where should we send the alpacas?)

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Step 1: Identify Data Sources

Web services like FRED (Federal Reserve Bank of St. Louis) provide economic data and indicators that cover banking, business, consumer price indexes, employment, population, GDP, and more.

The screenshot shows the homepage of the FRED Economic Research website. At the top, there's a search bar with placeholder text "Search FRED e.g., gdp, inflation, unemployment". Below the search bar, a banner states "Download, graph, and track 567,000 US and international time series from 87 sources." To the right of the banner is a "FRASER" sidebar with a brief description of what it offers: "Discover economic history with data, research, and more in FRASER, our digital library." The main content area features several data cards with graphs and text. One card for "Consumer Price Index for All Urban Consumers: All Items" shows a 1.2% change from May to June 2019. Another card for "Real Gross Domestic Product" shows a 3.1% change from the previous period. A third card for "Industrial Production Index" shows a 0.4% change from May 2019. Other cards include "U.S. / Euro Foreign Exchange Rate", "Civilian Unemployment Rate", "All Employees: Total Nonfarm Payrolls", and "4-Week Moving Average of Initial Claims".

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Step 1: Identify Data Sources

The screenshot shows the homepage of the World Bank Open Data website. At the top, there's a search bar with placeholder text "Search data e.g. GDP, population, Indonesia". Below the search bar, a banner says "Free and open access to global development data". The main content area is divided into several sections. On the left, there's a "MOST RECENT" section with news items: "World's population will continue to grow and will reach nearly 10 billion by 2050" by E. Suzuki (Jul 08, 2019), "Harnessing the power of data so no child is left behind" by O. Fiala (Jul 08, 2019), and "New country classifications by income level: 2019-2020" by World Bank Data Team (Jul 01, 2019). In the center, there's a "WHAT YOU CAN LEARN WITH OPEN DATA" section featuring a chart titled "Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of population)" showing data from the World Bank. To the right, there's a "THE NEW World Development Indicators" section with a thumbnail image and some text. At the bottom, there are two buttons: "View all news" and "View all blogs".



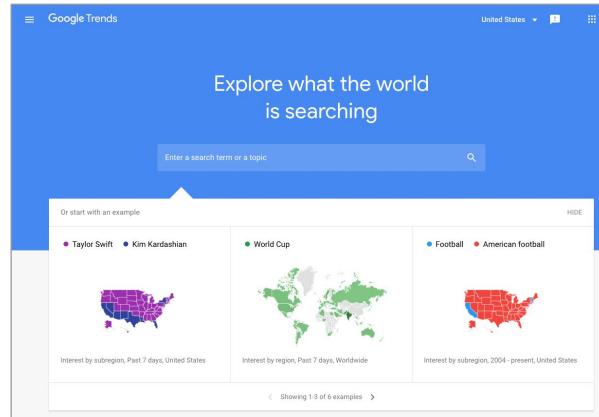
Lots of Data!

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Step 2: Build a Data Retrieval Plan

We could retrieve this data by brute force, but it would be:

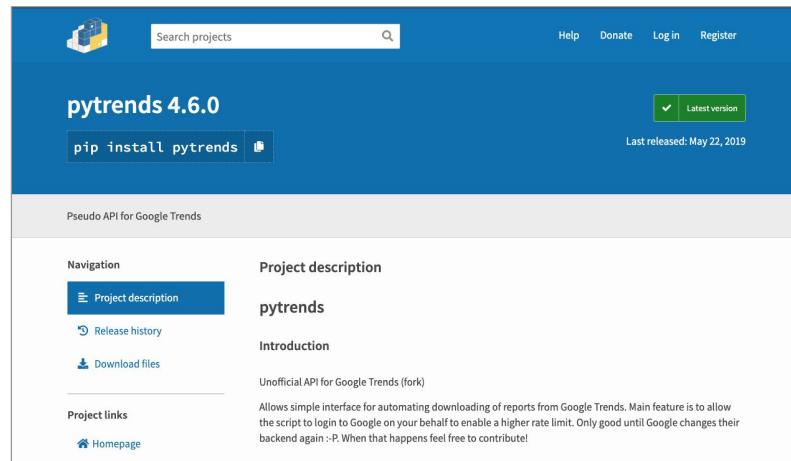
-  Extremely time consuming
-  Skewed by our city familiarity
-  Labor intensive



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Step 2: Build a Data Retrieval Plan

Thankfully, we can take advantage of the [pytrends API](#) to programmatically run our queries. (#ThankGoodnessForProgramming)



The screenshot shows the GitHub project page for "pytrends" version 4.6.0. At the top, there's a search bar and navigation links for Help, Donate, Log in, and Register. Below that is a large blue header with the text "pytrends 4.6.0" and a "Latest version" button. A "pip install pytrends" button is also visible. The main content area has a grey header "Pseudo API for Google Trends". On the left, there's a sidebar with "Navigation" sections for Project description, Release history, Download files, and Project links. The "Project description" section contains the title "pytrends" and a brief introduction: "Unofficial API for Google Trends (fork)". The introduction notes: "Allows simple interface for automating downloading of reports from Google Trends. Main feature is to allow the script to login to Google on your behalf to enable a higher rate limit. Only good until Google changes their backend again :-P. When that happens feel free to contribute!"

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Step 3: Retrieve the Data with Python

```
In [3]: # Create payload and capture API tokens. Only needed for interest_over_time(), interest_by_region() & related_queries()
()
pytrends.build_payload(kw_list=['alpaca'])
```

```
In [4]: # Interest Over Time
interest_over_time_df = pytrends.interest_over_time()
interest_over_time_df.head()
```

```
Out[4]:
alpaca  isPartial
date
2014-07-13    50   False
2014-07-20    53   False
2014-07-27    49   False
2014-08-03    52   False
2014-08-10    52   False
```



This funky code will search Google trends for "alpacas" and return the data...

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Step 4: Assemble and Clean the Data

```
In [7]: # Interest by Region
interest_by_region_df = pytrends.interest_by_region(resolution='COUNTRY', inc_low_vol=True, inc_geo_code=False)
print(interest_by_region_df.head())
```

```
alpaca
geoName
Afghanistan      0
Albania          4
Algeria          1
American Samoa   0
Andorra          0
```

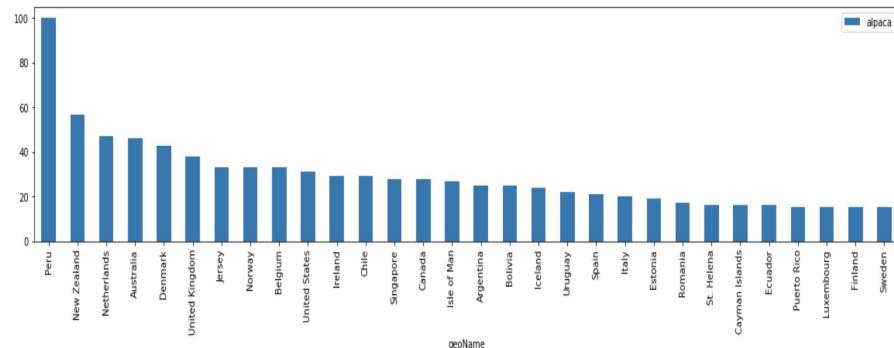


...which we can clean up, and then group results by country...

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Step 5: Analyze for Trends

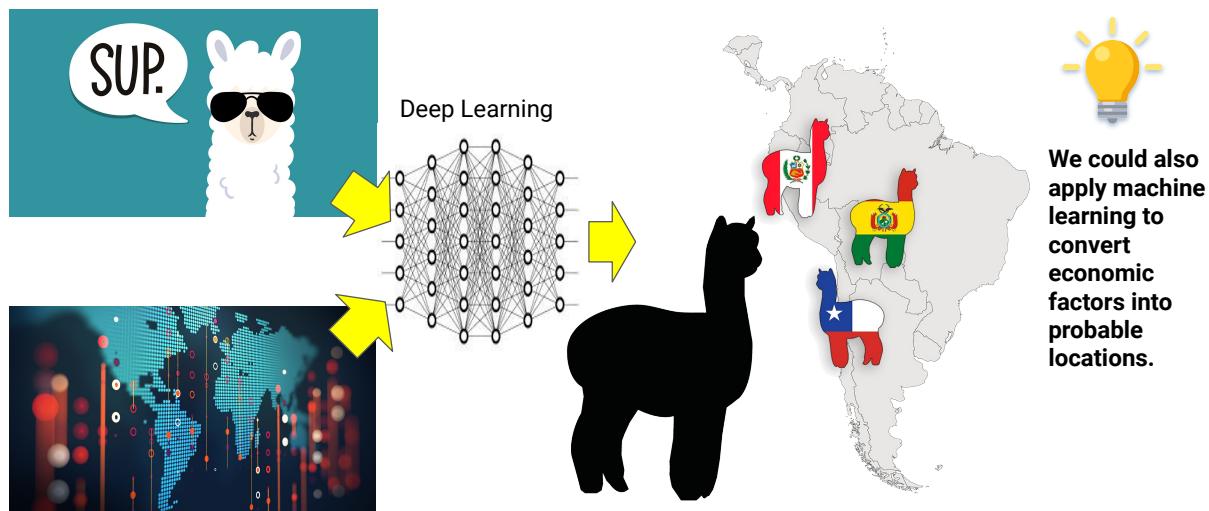
```
In [20]: interest_by_region_df.sort_values(by='alpaca', ascending=False)[0:30].plot(kind='bar', figsize=(20, 4), sort_columns=True)
Out[20]: <matplotlib.axes._subplots.AxesSubplot at 0x122a21240>
```



Finally, we can visualize the trends to see that Peru is the best location based on search trends. Obviously, there are other factors to consider, but we are rolling with this for now!

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Bonus: Apply Machine Learning!



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More Money, More Problems

(How do we purchase animals with donation money?)

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Cross-Border and Localized Payments

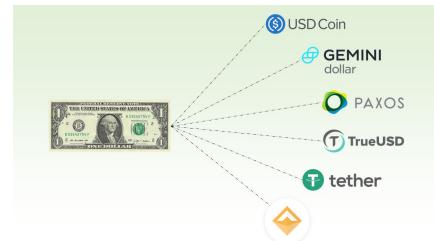
How do we move money easily in places where banking infrastructure is not stable?



Cryptocurrencies have provided a way to easily move value between borders. This is valuable in environments where the financial infrastructure is either unstable or nonexistent.



Stablecoins have provided a way to use blockchain technology without volatility.



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Alpaca Your Bags

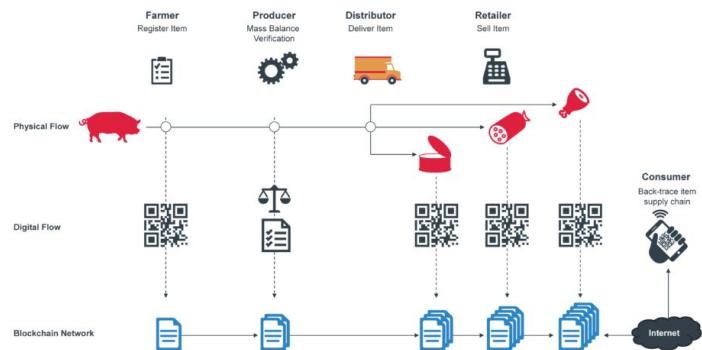
(Did the animal arrive at the destination?)

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Blockchain Logistics

We can address accountability, governance, transparency, and efficiency with cutting-edge DeFi technology.

By targeting the supply chain and leveraging blockchain technology, we can trace the impact of the strategy from the initial donation to the event itself.



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Wool You Buy This?

(How does the recipient sell the alpacas' wool?)

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Mobile and Online Merchants

Using DeFi technologies, anyone, anywhere can become their own merchant and be their own bank.



By creating an online marketplace, wool harvests can be sold cross-border and locally without any intermediaries.



Anyone can become their own merchant with just a cell phone.



This enables new economic activity and encourages market growth.



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Shear Scale of Impact

(Did the donation actually help?)

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Analyzing Socioeconomic Impact

We can use similar techniques to examine the effectiveness of the charity.

Analyze Wool Sales in the Region



Analyze Economic Indicators



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Tracking Transactions

By leveraging DeFi technologies, you can examine blockchain data and analyze the transaction flow.



You can analyze volume and transaction flow in the region with the wool purchases from the online and peer-to-peer markets.

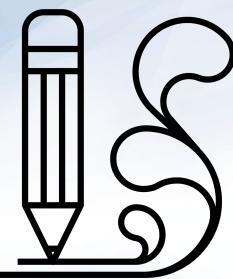


Proof can be embedded into the transaction.



Transactions			
Tx	0x840bcc019f...	From 0xf3630c948c8bc62...	0 Eth
	54 secs ago	To 0xb8b0db0337d421...	
Tx	0xa5ccb87e15...	From 0xde253c56e3f4fb...	0 Eth
	54 secs ago	To 0x4bcba6f74eec03d...	
Tx	0x3c838d2f67...	From 0x1d7e1445cc09a30...	0.15 Eth
	54 secs ago	To 0xe22160dad38907...	
Tx	0xefcbb0fe1d...	From 0x761c4412f0864e...	0 Eth
	54 secs ago	To 0x4dd672e77c7958...	
Tx	0xb514a72c51...	From 0x0e95f8f8ecbd70...	0 Eth
	54 secs ago	To 0x8fdcc30eda7e94f...	
Tx	0x96a08f02d8...	From 0x0e95f8f8ecbd770...	0 Eth
	54 secs ago	To 0x8fdcc30eda7e94f...	
View All Transactions			

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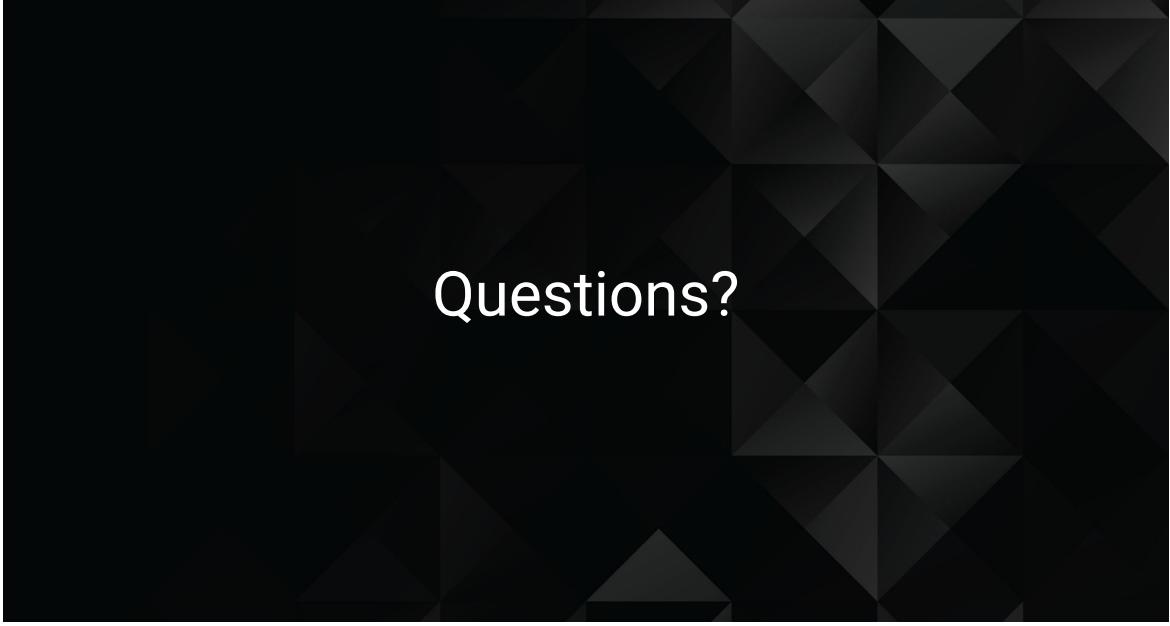
Homework: FinTech Case Study

In this homework assignment, you will develop a case study for a particular FinTech company or technology.

(Instructions sent via Slack.)



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Questions?