

Course name: Innovation in FinTech

Lecture: Cryptocurrency

Lecturer Jamsher Radjabov

PRESENTATION OVERVIEW

- Project Scope / Introduction
 - Companies / Business Understanding
 - Data Understanding
 - Data Preparation / Process
 - Results
 - Final thoughts
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

BUSINESS UNDERSTANDING

COMPANIES



NETFLIX



fiserv.



BITCOIN



Created back in 2008, it has gone through phases of criticism and growth and recently breaking the ten thousand dollar mark as a traded stock. It started to gain momentum back in 2014 but recently the world has taken notice of the electronic currency.

The hype surrounding Bitcoin has many starting to believe it may be a bubble, so how does the hype around this cryptocurrency compare to the hype around other, more household companies?

BUSINESS UNDERSTANDING

BITCOIN

Bitcoin is a cryptocurrency, a digital asset designed to work as a medium of exchange that uses cryptography (practice and study of techniques for secure communication in the presence of third parties called adversaries) to control its creation and management.



DATA UNDERSTANDING

TWITTER

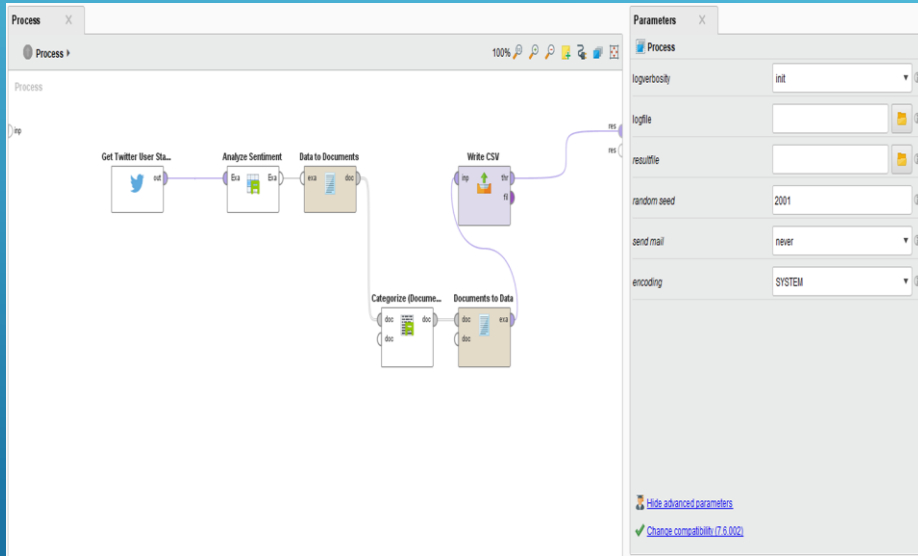


- **GOAL:** produce sentiment “scores” based on the text found in a company’s Tweet
 - Weight these scores by retweet quantity
- Start with Tweet collection on the 6 companies to have their own train and test sets
 - **Training**
 - Apply Aylie to train set in order to have Tweets labelled “positive”, “negative”, or “neutral”
 - Use labelled Tweets to train a classification model for each company
 - **Testing**
 - Apply the model to the test set
 - Compare sentiment patterns of each company, particularly against that of Bitcoin, to see what differences appear

- **GOAL:** produce sentiment “scores” based on the text found in articles from two different websites.
- Start with the 12 different article collections on the 6 companies
 - **Lexicon Approach**
 - Taking these articles and running them through a sentiment analysis process that determines sentiment scores based on a positive and negative lexicon.
 - **Aylien**
 - Running the same articles through Aylien’s analyze sentiment operator and picking out specifically the polarity. Lastly cross referencing it with the Lexicon approach above.

DATA PREPARATION

TWITTER



- Gather 10,200 training data points
- Use Aylien to add sentiment classification with meta confidence score
- Eliminate anything below a 90% confidence level
- Hand sorted the remaining data for strong points
- Build cross validated machine learning model

DATA PREPARATION

NEWS

- Finding the News Sources (trial and error)
- Once found searching each news site based on company
- Once each correct seed page was found run web crawling
- Run on both News sites for each company saving it to a different file.

The screenshot displays a web crawling software interface. The main window shows a process flow with a 'Crawl Web' node. Below it, the 'Edit Parameter List: crawling rules' dialog is open, showing a table of rules. The 'Parameters' panel on the right shows various settings for the 'Crawl Web' process, including the URL, crawling rules, max crawl depth, and options for retrieving HTML, enabling basic auth, adding content as attributes, and writing pages to disk.

Process

Process

inp

Crawl Web

res

res

Edit Parameter List: crawling rules

Edit Parameter List: **crawling rules**
Specifies a set of rules that determine, which links to follow and which pages to process.

rule application	rule value
follow_link_with_matching_url	+/news/./+/search?q=bitcoin.+
store_with_matching_url	+/news/./+

Add Entry Remove Entry Apply Cancel

Parameters

Crawl Web

url /search?q=bitcoin

crawling rules Edit List (2)...

max crawl depth 1

retrieve as html

enable basic auth

add content as attribute

write pages to disk

[Hide advanced parameters](#)

Help

Crawl Web
Web Mining

DATA PREPARATION

NEWS

- Looking at the first few web pages and quickly reading them to make sure they are relevant pages.
- Perform correct file management to have all the collected pages in one location labeled correctly.

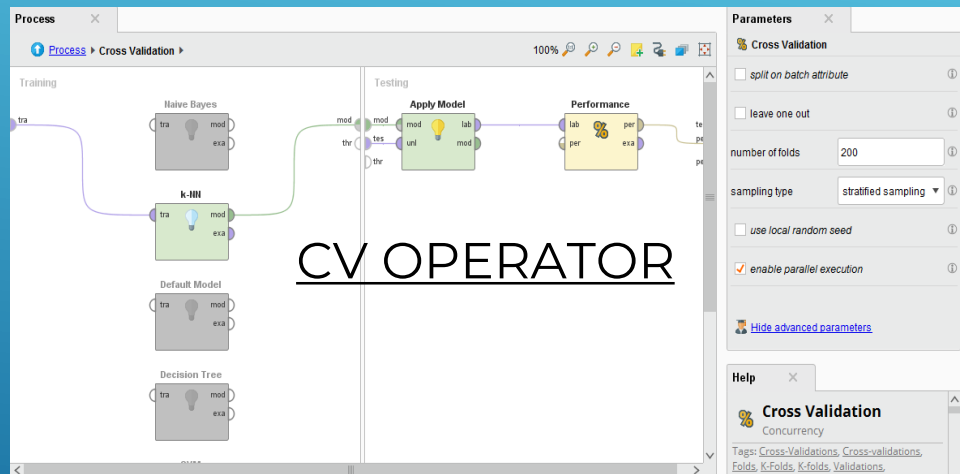
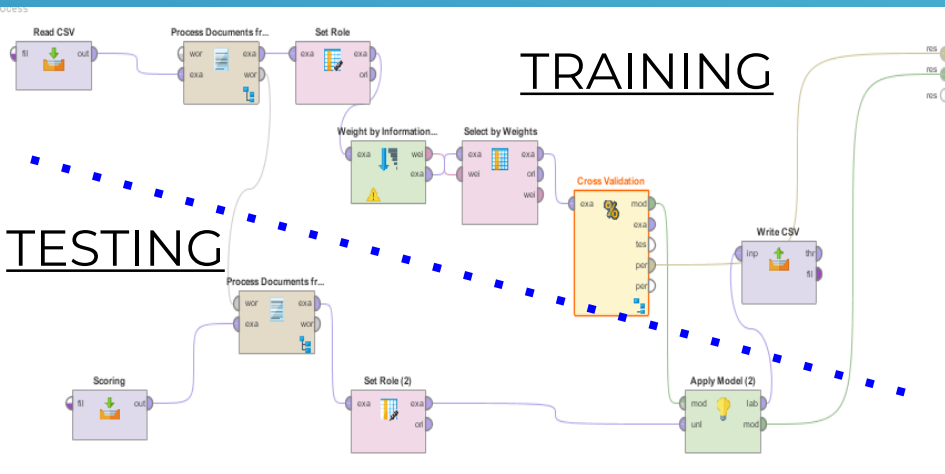
<input type="checkbox"/>	Name	Date modified	Type	Size
	Bitcoin Past Sep	12/5/2017 12:23 P...	File folder	
	BitcoinBBC	12/5/2017 12:28 P...	File folder	
	CSV	12/5/2017 1:18 PM	File folder	
	EthereumBBC	12/5/2017 12:29 P...	File folder	
	EthereumBBC Outside range	12/5/2017 12:31 P...	File folder	
	M&TBankBBC	12/5/2017 12:31 P...	File folder	
	Netflix BBC	12/4/2017 9:07 PM	File folder	
	Netflix BBC Second try	12/4/2017 9:11 PM	File folder	
	PNC BBC	12/4/2017 9:17 PM	File folder	
	PNC BBC 2	12/4/2017 9:20 PM	File folder	

	Bitcoin boom prompts growth of coin...	12/4/2017 8:38 PM	HTML File	158 KB
	Bitcoin fraud suspect Vinnik charged ...	12/4/2017 8:39 PM	HTML File	159 KB
	Bitcoin swings as civil war looms	12/4/2017 8:39 PM	HTML File	163 KB
	Burger King launches WhopperCoin cr...	12/4/2017 8:38 PM	HTML File	156 KB
	China orders Bitcoin exchanges in cap...	12/4/2017 8:39 PM	HTML File	160 KB
	Is the next financial scandal waiting to...	12/4/2017 8:39 PM	HTML File	165 KB
	popularity page	12/4/2017 8:38 PM	HTML File	845 KB
	Scenes from the crypto gold rush	12/4/2017 8:38 PM	HTML File	140 KB
	Scotland	12/4/2017 8:39 PM	HTML File	171 KB
	Tech Tent The crypto-currency craze	12/4/2017 8:47 PM	HTML File	136 KB
	Visitors 'help' Pirate Bay mine virtual c...	12/4/2017 8:38 PM	HTML File	155 KB
	Websites hacked to mint crypto-cash	12/4/2017 8:38 PM	HTML File	162 KB

PROCESS

TWITTER

Each company had the same general process layout, just with different attributes along the way to optimize training accuracy

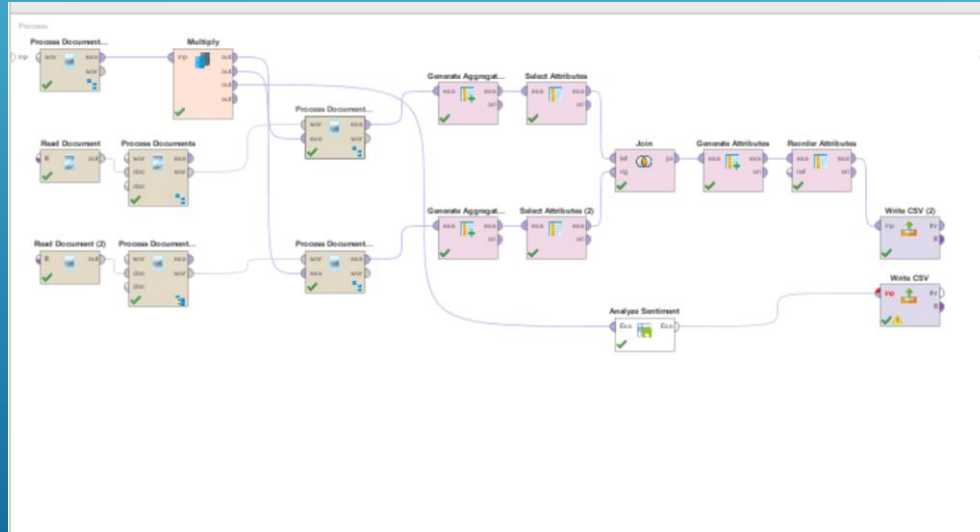


Final output was a tidy CSV containing that company's TD matrix, plus each Tweet and its specific confidence score, retweet count, and class (positive, negative, or neutral) prediction


SENTIMENT ANALYSIS PROCESS

NEWS

Each company over the two different new sources had its own process that all wrote one csv with the appended information outputted from the process.



RESULTS

- The Sentiments found by Aylien and the Lexicon based approach discussed in class for the majority of the articles on business related topics were pretty closely related.
 - But as the scores narrowed in on zero it become less and less stable of a prediction.
 - For some of the cases the prediction ended up being incorrect.
- 
- A decorative graphic consisting of several parallel white lines of varying lengths and orientations, located in the bottom right corner of the slide.

RESULTS


Bitcoin BBC

A	B	C	D	E	F
Title	polarity_confidence	subjectivity_confidence	polarity		
Cyber-thieves seek to cash in on Bitcoin boom - BBC News	0.815235376	0	positive		
Bitcoin boom prompts growth of coin-mining malware - BBC News	0.721431077	0	neutral		
Bitcoin fraud suspect Vinnik charged by US grand jury - BBC News	0.835014284	0	negative		
Bitcoin swings as civil war looms - BBC News	0.509625971	0	positive		
Burger King launches WhopperCoin crypto-cash in Russia - BBC News	0.493777245	0	negative		
China orders Bitcoin exchanges in capital city to close - BBC News	0.598257303	0	neutral		
Is this the next financial scandal waiting to happen? - BBC News	0.885236919	0	negative		
Bitcoin - BBC News	0.488530159	0	positive		
Scenes from the crypto gold rush - BBC News	0.878582835	0	positive		
Scotland's papers: Kezia voted out of the jungle - BBC News	0.882627964	0	positive		
Tech Tent: The crypto-currency craze - BBC News	0.498891443	0	negative		
Visitors 'help' Pirate Bay mine virtual cash - BBC News	0.772151768	0	positive		
Websites hacked to mint crypto-cash - BBC News	0.461004943	0	neutral		
Title	SumPos	SumNeg	Sentiment	Polarity	
Cyber-thieves seek to cash in on Bitcoin boom - BBC News	2	2	0 Neutral		
Bitcoin boom prompts growth of coin-mining malware - BBC News	32	30	2 Neutral		
Bitcoin fraud suspect Vinnik charged by US grand jury - BBC News	15	27	-12 Negative		
Bitcoin swings as civil war looms - BBC News	41	64	-23 Negative		
Burger King launches WhopperCoin crypto-cash in Russia - BBC News	26	30	-4 Neutral		
China orders Bitcoin exchanges in capital city to close - BBC News	19	26	-7 Negative		
Is this the next financial scandal waiting to happen? - BBC News	39	66	-27 Negative		
Bitcoin - BBC News	14	15	-1 Neutral		
Scenes from the crypto gold rush - BBC News	37	31	6 Positive		
Scotland's papers: Kezia voted out of the jungle - BBC News	13	19	-6 Negative		
Tech Tent: The crypto-currency craze - BBC News	29	29	0 Neutral		
Visitors 'help' Pirate Bay mine virtual cash - BBC News	20	24	-4 Neutral		
Websites hacked to mint crypto-cash - BBC News	39	41	-2 Neutral		
Positive is a score of 5 or more					
Negative is a score of -5 or less					
Neutral is between -5 and 5					

Bitcoin USA Today

P	Q	R	S	T
Title	polarity_confidence	subjectivity_confidence	polarity	
Bitcoin–ma	0.817870378	0	negative	
Bitcoin's value u	0.904324293	0	negative	
This investment	0.792482555	0	negative	
401(k) at risk? W	0.59579742	0	neutral	
Bitcoin; What is	0.963331878	0	positive	
Trailer for Kathr	0.806020141	0	negative	
Revlon acquiring	0.657444358	0	positive	
Being black in te	0.974470019	0	neutral	
Roy Williams, Nc	0.814998388	0	neutral	
Centenarian cou	0.783831894	0	positive	
House edits rule	0.828811467	0	neutral	
Bitcoin speculati	0.712131143	0	negative	
For Walmart, Ta	0.773544669	0	positive	
N.C. Gov. declari	0.978386343	0	positive	
Deacons for Defi	0.882791042	0	negative	
How this Coptic	0.490449369	0	negative	
Title	SumPos	SumNeg	Sentiment	Polarity
Bitcoin–ma	19	20	-1 Neutral	
Bitcoin's value u	14	20	-6 Negative	
This investment	46	51	-5 Neutral	
401(k) at risk? W	42	66	-24 Negative	
Bitcoin; What is	42	34	8 Positive	
Trailer for Kathr	3	12	-9 Negative	
Revlon acquiring	22	12	10 Positive	
Being black in te	4	9	-5 Neutral	
Roy Williams, Nc	21	20	1 Neutral	
Centenarian cou	7	5	2 Neutral	
House edits rule	9	9	0 Neutral	
Bitcoin speculati	28	36	-8 Negative	
For Walmart, Ta	3	1	2 Neutral	
N.C. Gov. declari	59	237	-178 Negative	
Deacons for Defi	29	21	8 Positive	
How this Coptic	21	20	1 Neutral	

RESULTS

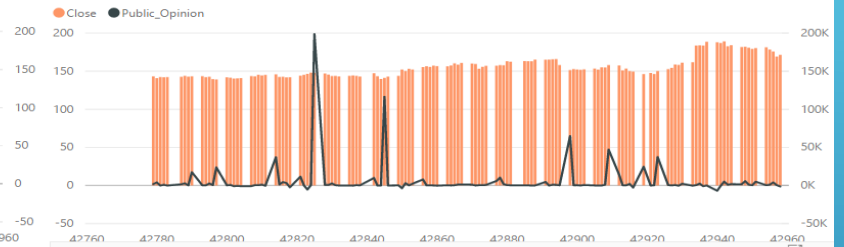
- No significant relationship between S&P 500 and Twitter
 - Relationships between health care and IT
 - Significant relationship w/ Twitter and Bitcoin
 - t-score = 4.5, coefficient = 4.02
 - No ethereum relationship, due to timeline
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

GENERAL COMPANIES

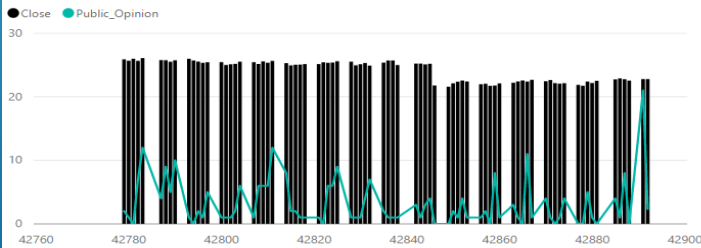
Fiserv Public Opinion/Closing Prices



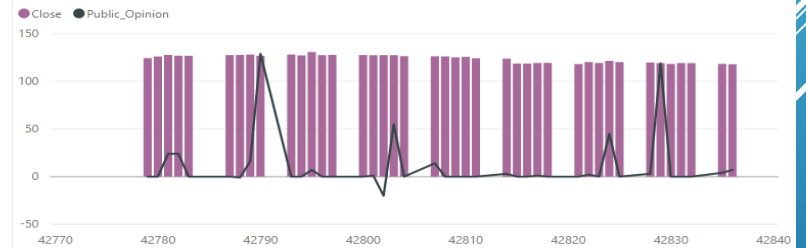
Netflix Public Opinion/Closing Prices



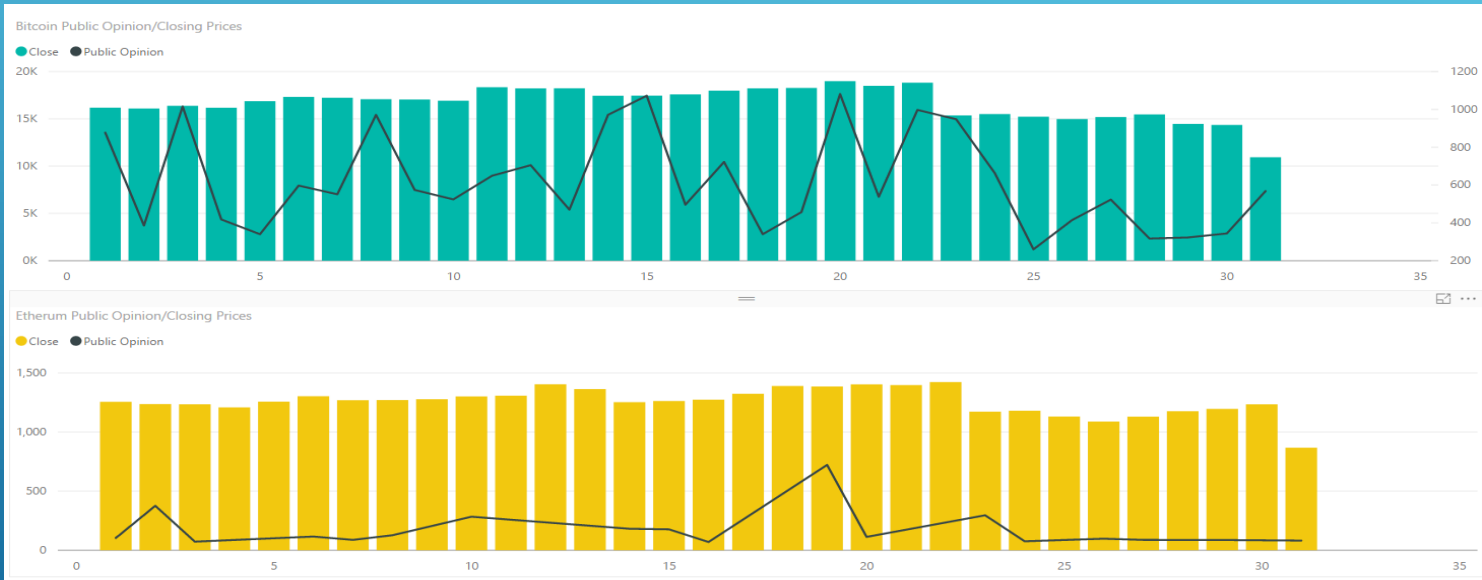
M&T Bank Public Opinion/Closing Prices



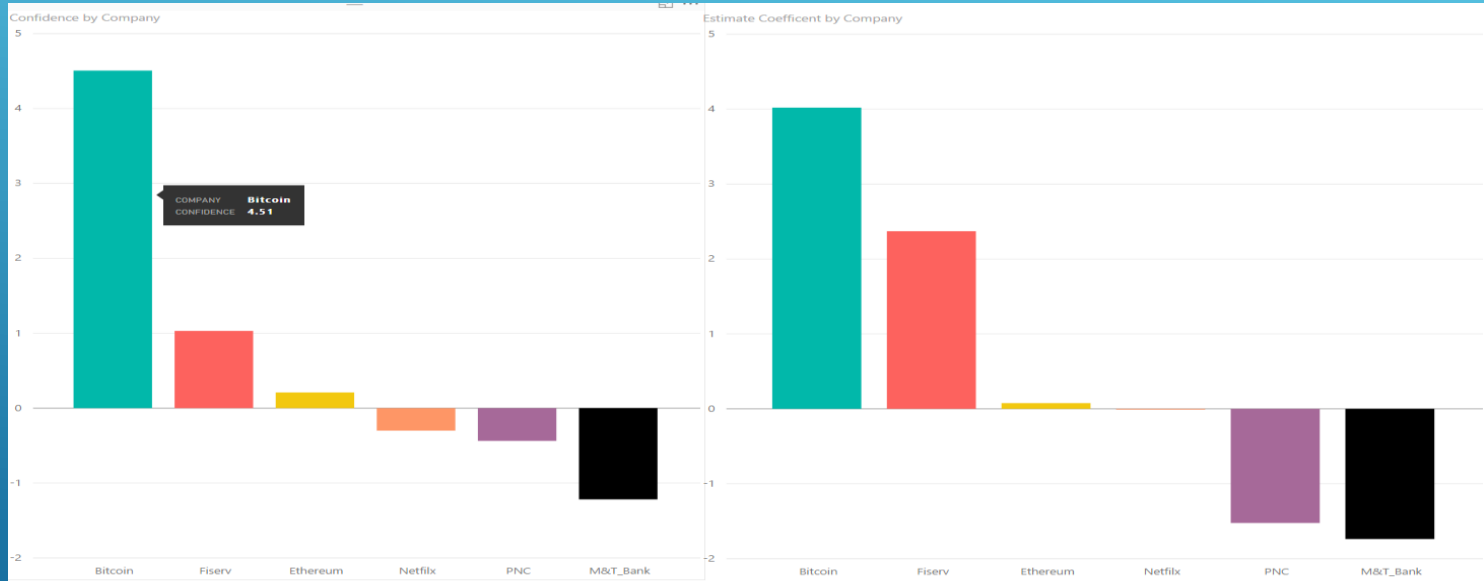
PNC Public Opinion/Closing Prices



CRYPTO COMPANIES



COEFFICIENTS AND SUPPORT



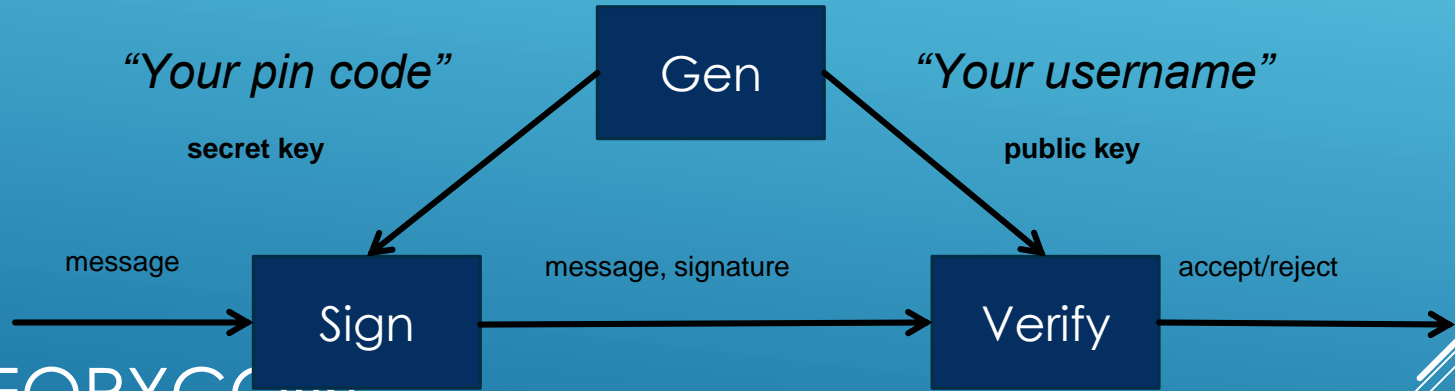
THEORYCOIN: HOW TO TRANSFER MONEY



(Digital) Signatures

- ▶ Only you can sign
- ▶ Everyone can verify
- ▶ You cannot deny



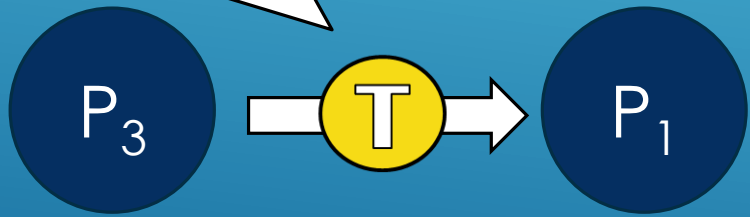


THEORYCOIN.
HOW TO TRANSFER MONEY

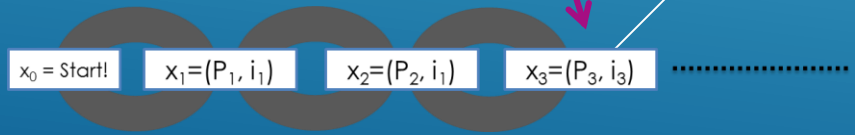
THEORYCOIN: HOW TO TRANSFER MONEY



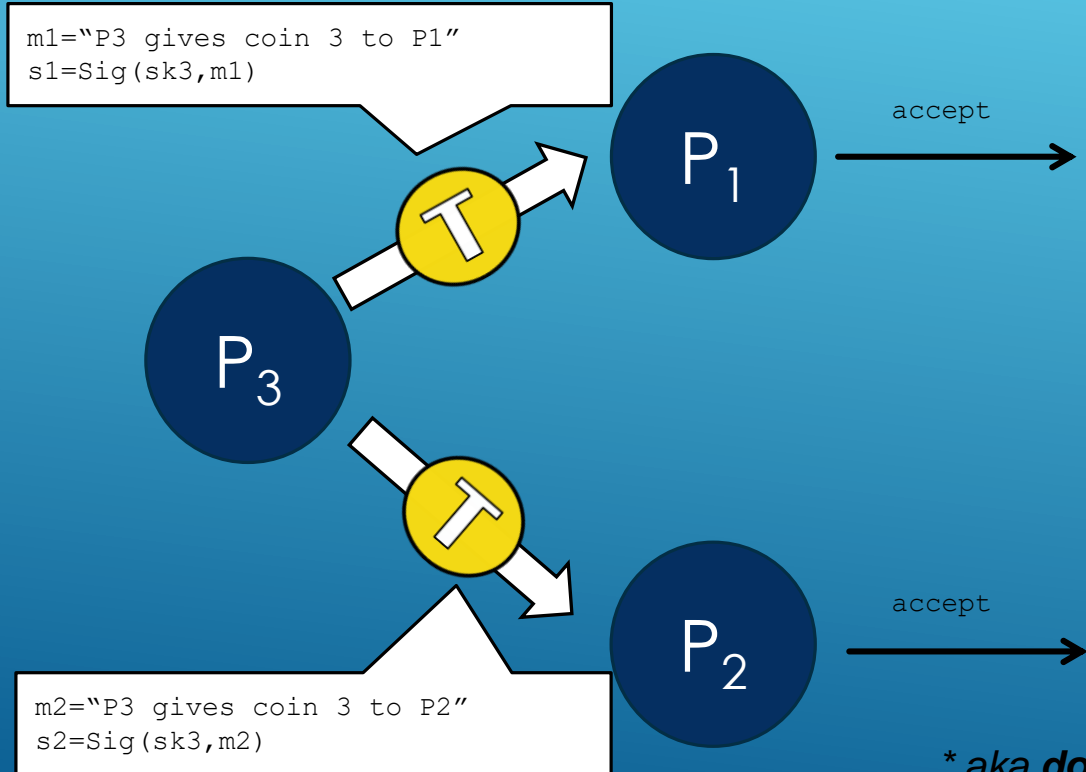
$m = \text{"P3 gives coin 3 to P1"}$
 $s = \text{Sig}(sk_3, m)$



If
 $\text{Ver}(pk_3, m, s) =$
accept
and
P3 owns coin 3
then
return accept

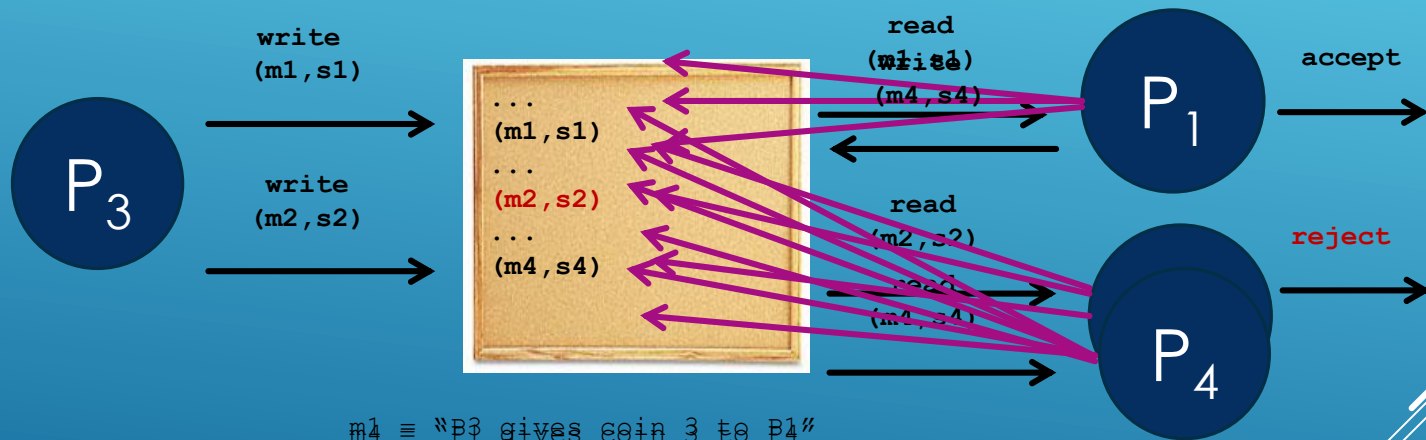


THEORYCOIN: HOW TO TRANSFER MONEY



** aka double spending*

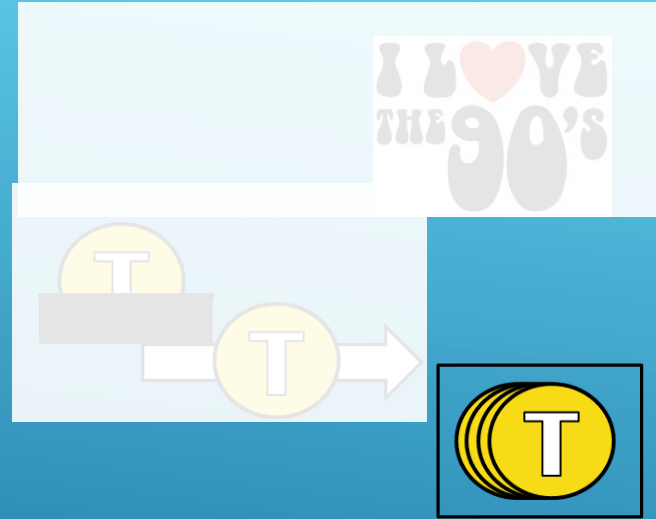
THEORYCOIN: HOW TO TRANSFER MONEY



$m_4 \equiv$ "P3 gives coin 3 to P4"
 $s_4 = \text{Sig}(\text{sk}_3, m_4)$

$m_2 =$ "P3 gives coin 3 to P2"
 $s_2 = \text{Sig}(\text{sk}_3, m_2)$

- ▶ **Part 0:** a little history
- ▶ **Part 1:** TheoryCoin
 - ▶ How to **create** coins
 - ▶ How to **transfer** coins
 - ▶ How to **store** coins
- ▶ **Part 2:** diff(,)
- ▶ **Part 3:** Problems and issues



OUTLINE



Main Idea:

Record **transfers** in the **blockchain**

THEORY

$x_0 = \text{Start!}$

$x_1 = (P_1, i_1)$

$x_2 = (P_2, i_1)$

$x_3 = (P_3, i_3)$

.....

HOW TO STORE MONEY

THEORYCOIN: HOW TO STORE MONEY

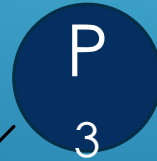


```
SolvePuzzle(L){  
  repeat(  
    R = my_name || i++  
    T = H(L,R)  
  )while(T ≠ 0d)  
  return R  
}
```



(m, s)

```
SolvePuzzle(L){  
  repeat(  
    R = my_name || i++  
    T = H(L,R)  
  )while(T ≠ 0d)  
  return R  
}
```



```
SolvePuzzle(L){  
  repeat(  
    R = my_name || i++  
    T = H(L,R)  
  )while(T ≠ 0d)  
  return R  
}
```



(m, s)



```
SolvePuzzle(L, ...){  
  repeat(  
    R = my_name || (m, s) || i++  
    T = H(L,R)  
  )while(T ≠ 0d)  
  return R  
}
```

$x_0 = \text{Start!}$

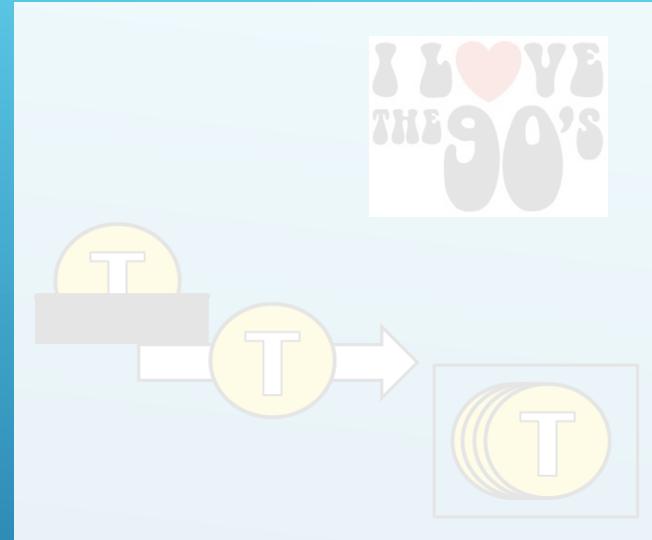
$x_1 = (P_1, i_1)$

$x_2 = (P_2, i_1)$

$x_3 = (P_3, i_3)$

$x_4 = (P_4, (m, s), i_4)$

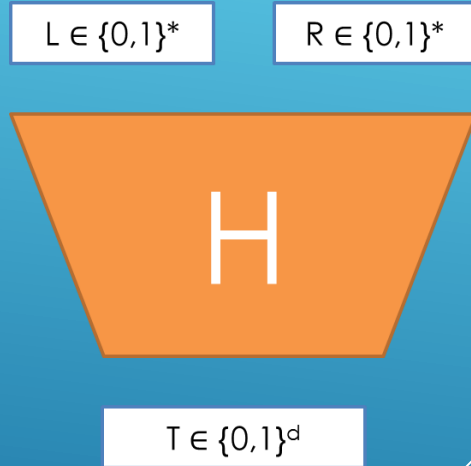
- ▶ **Part 0:** a little history
- ▶ **Part 1:** TheoryCoin
 - ▶ How to **create** coins
 - ▶ How to **transfer** coins
 - ▶ How to **store** coins
- ▶ **Part 2:** diff(,)
- ▶ **Part 3:** Problems and issues



OUTLINE



- ▶ New block **every ~10 mins**
 - ▶ **d** adjusted every ~2000 blocks
- ▶ $H = 2\text{-SHA2}$

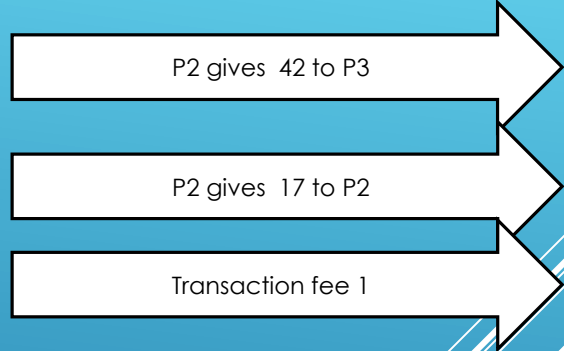
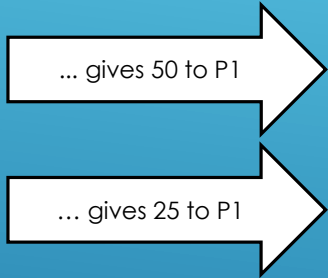


DIFF()

▶ Initial reward: **50 BTC**

HOW IS MONEY CREATED IN BITCOIN?

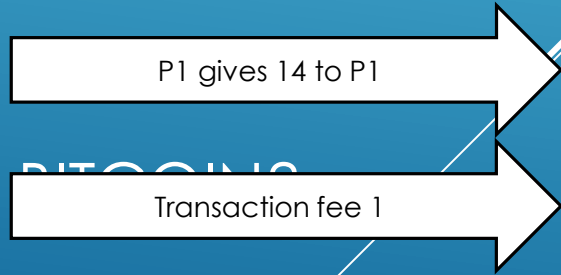
▶ Halved every ~4 years (now **25 BTC**)



Example: P1 wants to give 60 to P2

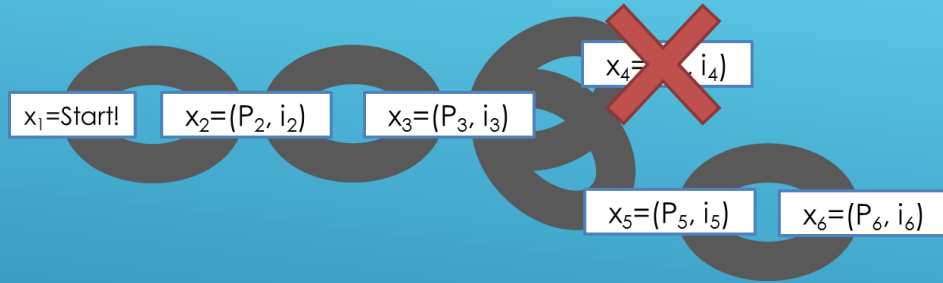
DIFF(,)

HOW IS MONEY TRANSFERRED IN BITCOINS





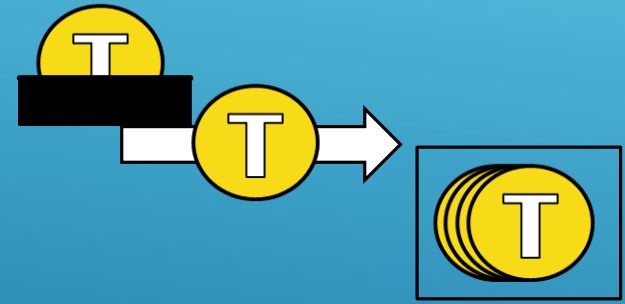
- ▶ Transaction in **orphaned blocks** are invalid
 - ▶ **Wait 6 blocks** (~1 hour) before accepting transaction.
 - ▶ **Checkpoints** to prevent complete history rollback.



- ▶ **All transaction** are stored in the blockchain
 - ▶ (Currently ~14 GB)

DIFF(,)
HOW IS MONEY STORED IN BITCOIN?

- ▶ **Part 0:** a little history
- ▶ **Part 1:** TheoryCoin
 - ▶ How to **create** coins
 - ▶ How to **transfer** coins
 - ▶ How to **store** coins
- ▶ **Part 2:** diff(,)
- ▶ **Part 3:** Problems and issues



OUTLINE

► Problem:

- Every transaction ever made is **recorded forever**



• Solution?

- Use **new identity** for each transaction

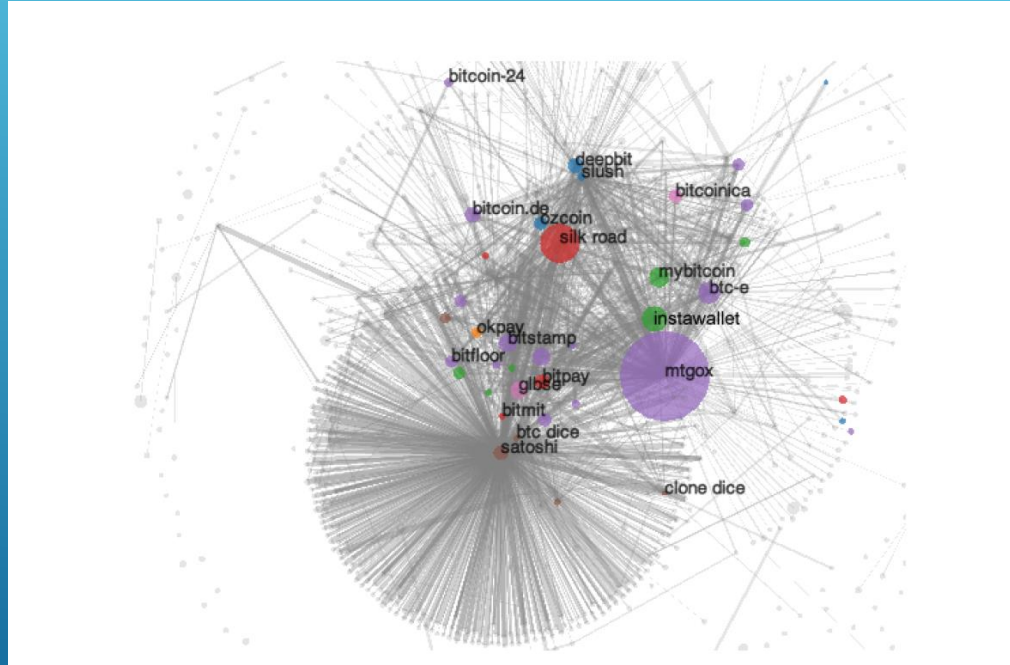
• But:

- Heuristics allow to **cluster** identities

• Anonymous alternatives:

- Zerocoin, Zerocash...

ANONYMITY?



USERS? (AND THEIR DEVICES)



- ▶ Unfortunate property of DSA



- ▶ This address

1HKywxilL4Jz1qXrzLKhmB6a74ma6kxbSDj

probably stole ~250000kr this way

(due to bug in Android Java based random generator)

PROGRAMMABLE MONEY?



“Bitcoin uses a **scripting system** for transactions. Forth-like, Script is simple, stack-based, and processed from left to right. **It is purposefully not Turing-complete, with no loops.**”

E.g., “P1 gives 1 BTC to P2 if at least 2 out of (P1,P2,P3) sign this transaction”

Functionality: more than money?

Security: malware payments?

MINING POOLS



- ▶ **Solving puzzles (mining) is hard!**
 - ▶ Miners join pools and share work/reward
- ▶ **How to optimally split work?**
- ▶ **Mechanism design?**
 - ▶ rational miner?
 - ▶ how to allocate reward?

Distributed currencies:


for the **good guys** or the **bad guys**?

- ▶ Crime is bad! Tax evasion is bad!
- ▶ But sometimes governments are bad too!

Thanks! Questions?

A FINAL WORD...

FINAL ASSERTIONS

- This should be continued until a market crash happens, analyze the sentiment to determine if there is a determining factor to mark the crash.
 - Analyze the sentiment of current and the crash to determine what attributes affect it most.
 - Use this to protect future investors.
- 
- A decorative graphic consisting of several parallel white lines of varying lengths and orientations, located in the bottom right corner of the slide.

Reference

1. The Innovation Ultimatum: Six strategic technologies that will reshape every business in the 2020s By Steve Brown.
2. Bank 4.0: Banking Everywhere, Never at a Bank By Brett King.
3. The World of Digital Payments: Practical Course By Pavlo Sidelov.
4. The PayTech Book Edited by a team of Susanne Chishti.
5. The Future Is Faster Than You Think: How Converging Technologies Are Disrupting Business, Industries, and Our Lives By Dr. Peter H. Diamandis.
6. Advances in Financial Machine Learning By Marcos Lopez de Prado
7. Financial Services Revolution: How Blockchain is Transforming Money, Markets, and Banking By Alex Tapscott.
8. The STO Financial Revolution: How Security Tokens Change Businesses Forever By Alex Nascimento.
9. FinTech Founders: Inspiring Tales from the Entrepreneurs that are Changing Finance By Agustín Rubini
10. The Innovation Ultimatum: Six strategic technologies that will reshape every business in the 2020s By Steve Brown