Research on cryptocurrencies and blockchain at the Agile Group

Michele Marchesi
Università di Cagliari - DMI

http://agilegroup.eu
Agile Group and Blockchain

- Agile Group is the software engineering research group of the University of Cagliari
- We started to study Bitcoin and Blockchain since 2014
- We were among the very first research groups to publish on international reviews on the subject (not considering cryptography)
- Strong collaboration with our spinoff FlossLab srl and other firms, on applied research projects
- Collaborations with foreign Universities and research institutions:
  - Univ. of Hartfield and Brunel Univ. (UK)
  - INRIA Lille (F)
  - Univ. Politecnica di Madrid (E)
Cited on Coindesk

Study: Google Searches Can Predict Bitcoin Trading Volume

Oct 2, 2015 at 10:16 UTC by Grace Faffyn

Google search data can predict the price of bitcoin, new research has found.

Academics from the University of Cagliari, Italy, compared USD trading volume with data from Google Trends in the 12 months leading up to July 2015.

The results, detailed in their **new paper**, indicated that search volumes for the keyword ‘bitcoin’ correlated with – and sometimes predicted – the currency’s market volumes.
Research topics - 1

- Modeling and simulation of cryptocurrency markets
- Modeling and simulation of miners business model
- Using an object-oriented event-driven stochastic simulator and heterogeneous agents approach
- Analysis of energetic implications of mining
- Use of Blockchain in electric market of renewable power sources
- Study of ICO (Initial Coin Offering) features, success factors and impact on public blockchains
Simulation of Bitcoin market and of mining business

• A model based on heterogeneous agents
• 3 kinds of traders:
  – random traders
  – chartists
  – (miners)
• Features of the model:
  – inflow of new traders
  – order clearing through a book
  – analysis of prices trend and statistical properties
  – analysis of the survivability of the various strategies in the long term
Bitcoin price between 1/12012 and 10/4/2014

Price of Bitcoins in US$, and number of unique addresses of the Blockchain
Simulated Bitcoin price

Price of the Bitcoin in the simulated market
Fig 5. The decumulative distribution function of the absolute returns.
Simulated Bitcoin price returns autocorrelation

Fig 6. Autocorrelation of (A) raw returns, and (B) absolute returns of Bitcoin prices.
Anaylsis of ICO features and success factors

- We analyzed 1387 ICOs, gathered on 31/12/2017 from icobench.com Web site
- We added info from coinmarketcap.com (financial data) and from ethplorer.io (Ethereum blockchain data)
- We performed an analysis of the features of the ICOs
- We defined as success factor having gathered more than 200.000 US$ for ICOs ended within November 2017
- We analyzed the significance of ICO features with respect to the ICO success
ICO features: countries

- USA: 245
- UK: 203
- Switzerland: 139
- Hong Kong: 106
- Australia: 79
- Netherlands: 75
- France: 50
- United Arab Emirates: 44
- Lithuania: 34
- British Virgin Islands: 30
- Thailand: 30
- Malaysia: 30
- Belarus: 25
- Kazakhstan: 25
- Taiwan: 20
- Brazil: 20
- Russia: 15
- Singapore: 15
- Germany: 15
- China: 15
- Japan: 15
- Gibraltar: 15
- Bulgaria: 15
- Latvia: 15
- South Africa: 15
- Belize: 15
- Seychelles: 15
- South Korea: 15
- Luxembourg: 15
- Belgium: 15
- Malta: 10
- Argentina: 10
- Russia: 10
- Unknown: 10
- Others: 10
- Canada: 5
- Slovenia: 5
- Ukraine: 5
- Spain: 5
- Czech Republic: 5
- Italy: 5
- Cayman Islands: 5
- Cyprus: 5
- Finland: 5
- Others: 5
ICO features: main categories
ICO features: platforms
ICO features: team size
ICO features: CCDF of token transfers (ERC-20 on Ethereum blockchain)
Research topics - 2

- Analysis of Blockchain transaction graph using complex network techniques
- Prediction of Bitcoin (and of other digital currencies) price and volume using Sentiment Analysis on social networks
- Prediction of time series, including cryptocurrencies price and volume using:  
  - neural networks  
  - wavelets
Research topics - 3

• Blockchain-oriented software engineering:
  – applications of software engineering to the issues of analysis, design, development and testing of Blockchain-based systems
• Use of Smart Contracts for data exchange among Public Bodies, using Blockchain and/or specific APIs
• Use of public Blockchains for document notarization, supply chain management and Internet of Things
Blockchain-oriented software engineering

• Challenges
  – New professional roles
  – Security and reliability
  – Software architecture
  – Modeling languages
  – Testing and debugging
  – Tools aiding the modeling and development of Smart Contracts
Blockchain-oriented software engineering

In order to define new research directions for the BOSE on the basis of the state-of-practice of blockchain-oriented software, we conducted an exploratory study on a corpus comprising 1184 GitHub software repositories, which were identified with the use of the Moody’s Blockchain Report.

<table>
<thead>
<tr>
<th>GitHub Repository</th>
<th>stargazers</th>
<th>contributors</th>
<th>open issues</th>
<th>age (days)</th>
<th>watchers</th>
<th>forks</th>
<th>first language</th>
</tr>
</thead>
<tbody>
<tr>
<td>bitcoin/bitcoin</td>
<td>9966</td>
<td>396</td>
<td>547</td>
<td>2105</td>
<td>1211</td>
<td>4266</td>
<td>C++</td>
</tr>
<tr>
<td>ethereum/go-ethereum</td>
<td>2160</td>
<td>78</td>
<td>285</td>
<td>1002</td>
<td>367</td>
<td>695</td>
<td>Go</td>
</tr>
<tr>
<td>ledger/ledger</td>
<td>1813</td>
<td>108</td>
<td>14</td>
<td>3055</td>
<td>103</td>
<td>255</td>
<td>C++</td>
</tr>
<tr>
<td>digitalbazaar/forge</td>
<td>1584</td>
<td>41</td>
<td>137</td>
<td>2260</td>
<td>103</td>
<td>241</td>
<td>JavaScript</td>
</tr>
<tr>
<td>ripple/ripple-client</td>
<td>1244</td>
<td>51</td>
<td>21</td>
<td>1437</td>
<td>968</td>
<td>486</td>
<td>JavaScript</td>
</tr>
<tr>
<td>ethereum/mist</td>
<td>1168</td>
<td>35</td>
<td>198</td>
<td>471</td>
<td>210</td>
<td>299</td>
<td>JavaScript</td>
</tr>
<tr>
<td>dogecoin/dogecoin</td>
<td>1153</td>
<td>300</td>
<td>52</td>
<td>1022</td>
<td>149</td>
<td>505</td>
<td>C++</td>
</tr>
<tr>
<td>ripple/rippled</td>
<td>1144</td>
<td>53</td>
<td>118</td>
<td>1782</td>
<td>246</td>
<td>338</td>
<td>C++</td>
</tr>
<tr>
<td>coinbase/toshi</td>
<td>839</td>
<td>18</td>
<td>97</td>
<td>749</td>
<td>98</td>
<td>187</td>
<td>Ruby</td>
</tr>
<tr>
<td>ethereum/cpp-ethereum</td>
<td>723</td>
<td>89</td>
<td>212</td>
<td>1001</td>
<td>196</td>
<td>270</td>
<td>C++</td>
</tr>
</tbody>
</table>
Blockchain-oriented software engineering

Extracted statistics across the top 10 repositories

Languages across 193 repositories
Publications


Pubblicazioni


Organized Events

  http://www.agilegroup.eu/iwbose2018/

  http://www.agilegroup.eu/wetseb2018/

• Vari seminari su Blockchain a Cagliari
Research projects ongoing, funded or proposed

- **AIND: Amministrazioni e Imprese Native Digitali**, con FlossLab srl, DISSI e DSEA – PIA financed by Regione Sardegna
- **SardCoin**: a token for tourism in Sardinia, financed by Sardegna Ricerche
- **Innovation projects** financed by Sardegna Ricerche:
  - *Easy Wallet*, with TrustMyPhone srl
  - *CAFCHA*, with FlossLab srl
  - *CryptoTrading*, with SelfieWealth srl
  - *Bertulas*, with Strateghia srl
- **Various projects** on call PON of MIUR, deadline 11/2017
Teaching Courses of Computer Science Master degree

- 2 courses with Blockchain and Smart Contracts in their program:
  - Cybersecurity: 6 CFU
  - Advanced Programming Techniques: 6 CFU

- Reading courses: 6 CFU each
  - Cryptocurrencies and smart contracts
  - Advanced software engineering (Blockchain-Oriented Software Engineering)