

18D027

Blockchain: From First Principles to Analytics

Spring Term - 3 ECTS

Elective Course

Gaston Besanson

Dr. Craig Chatfield

Prerequisites to Enroll

Prerequisites to enroll: 1) Course in DS done with BGSE. 2) Programming experience with one of these languages Python, R, Java, Javascript, Go.

Overview and Objectives

Blockchain is a disruptive foundation technology that enables complex use cases where a single source of truth is needed. It is part of the resulting technology stack in the transition from centralized computing, storage, and processing to decentralized architectures and systems.

This course will explore the technologies that make up the 'blockchain' technology and how this technology comes together to solve many common problems in business today. Beside the payments use case (cryptocurrencies and stable coins), Blockchain technology opens many opportunities to redesign collaborative business processes such as supply chain and logistics processes.

Real world example businesses will be spotlighted as examples, and industry experts will present on their blockchain experience, and business experience with the technology. Students will have a firm grasp on the far-reaching possibility of the technology and be inspired to create their own new implementation.

The students will have a hands-on experience to create a blockchain applications and see how blockchain data and system interacts with the data science world and the analytics perspective.

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Course Outline

Session 1: Discover and Understand Blockchain

Instructor: Craig Chatfield

What is the Blockchain:

- Definition of a Blockchain
- Immutability (Cryptography, Hashing)
- Verifiability (Public / Private keys, Digital Signature)
- Decentralization
- Consensus Algorithms (Community, Rewarding system, Proof-of-work, Proof-of-stake, others)
- Tokens
- Smart Contracts
- Blockchain Platforms

Session 2: Blockchain in Business

Instructor: Craig Chatfield

Explain why the blockchain technology is relevant for the business world.

- Enterprise Blockchain Solutions
- Common Blockchains Use Cases
- Blockchain Solution Value

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Session 3: Blockchain Business Use Cases (2 Hours)

Instructor: Craig Chatfield

Students will examine common industry use cases for blockchain, and examine different solution examples in these industries:

- Government
- Health
- Education
- Fintech and Payments
- Insurance
- Supply Chain
- Import/Export
- Digital Media
- Real Estate

Session 4: Blockchain Project Delivery

Instructor: Craig Chatfield

- Development of Blockchain Projects
 - Solution Definition
 - Ecosystem Governance
 - Project Development
 - Solution Operations
- Discussion of the Student Blockchain Use Cases with Craig Chatfield

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Session 5: Blockchain in the Data Science space

Instructor: Gaston Besanson with Sandra Orozco and Hamza Diaz

- What is Blockchain to a Data Scientists
 - Recap of industry uses cases
 - Source of data
 - Federated Learning
 - Introduction to the challenge: Analytics solutions for Blockchains
- Hands on exercises
 - Build a Plain Vanilla Blockchain in R
 - Hyperledger Playground

Session 6: Dapps: Decentralized Applications

Instructor: Gaston Besanson with Adria Aguiló and Hamza Diaz

- Why Dapps?
 - Recap on what is a Dapps
 - Examples
 - Last year class presentations
 - Discuss Dapps' role in the Analytics Challenge
- Hands on exercises
 - Hands on exercises with Ethereum and Dapps
 - Create a Dapp

Session 7: Use Cases & Applications

Instructor: Gaston Besanson with Sandra Orozco and Xabier Beraza

- Finance:
 - Central Bank Digital Currency
 - ICO: Tokens
- Supply Chain
 - IoT – Track and Trace
- Hands on exercises
 - NLP Analysis to ICO whitepapers

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- Strategies to trade tokens: Reinforcement Learning
- Example of the use of Network Analysis on Blockchain data
- Discuss Dapps' role in the Analytics Challenge

Session 8: Use Cases & Applications

Instructor: All

- Students will present the prototype of the solutions

Required Activities

The students will have hands-on activities during the course that are key for the successful completion of the projects.

Evaluation

The course will be evaluated by two projects. One is focus on the development of a business case, while the other on an analytics solution for blockchains. Both will count for half of the grade. The delivery of both projects will be agreed at the beginning of each section of the course. The project must be done by teams of 2 people. Only in exceptions a team of three will be accepted.

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Competences

- Construct a global vision of the situation of the problem based on knowledge of the synergies between advanced statistical methods, computing and business analysis to generate added value.
- Solve the real problems that arise in the fields of study through the accurate analysis of the data.
- Visualize and interact with high-dimensional data in order to contextualize the information and facilitate subsequent decision-making.
- Communicate with conviction in English the results and implications of the required analytical study using a language related to the receiver.
- That students know how to apply the acquired knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
- That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.

Learning Outcomes

- Apply mathematical and computational analysis of social, business and economic networks knowing the theory and optimization algorithms.
- Work with databases and cloud computing.
- Express in computer language the resolution of complex problems with high-dimensional data.
- Create visualizations of information according to each type of data.
- Sort the information in a visual and understanding mode from the selection and qualification of the data.
- Present information visually and in an orderly manner to improve decision making.
- Answer the question "And then what do we do?" Based on the information obtained and presented.

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- Collaborate in a computing environment that requires structuring and planning.

Materials

The material will be provided by the Lecturers.