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COMPLEXITY SCIENCE HUB VIENNA

CSH Internship Program

Call for Interns 2024

The Complexity Science Hub Vienna is offering six internship positions to solve exciting problems during 6-8 weeks at CSH in Vienna.

This year's program begins on June 26, 2024.

Application deadline: January 31, 2024

Successful candidates will be informed by February 28, 2024.

Who we are

The Complexity Science Hub is a young research institution dedicated to a deeper quantitative and predictive understanding of complex systems for the betterment of society. We provide an exciting, creative, bureaucracy-free environment for open-minded visionaries who want to make a change and are brave enough to step out of mainstream science.

What we offer

CSH interns will work on one of six possible projects, under the expert supervision of a CSH researcher. Applicants should indicate their preferred project in the application form. Please review the detailed project descriptions below.

The program begins with a welcome week for all 2024 interns, which offers an introduction to complexity science through lectures and guided readings. There will be opportunities to get to know the entire CSH research community and other interns through social activities and a reception dinner.

Interns are invited to participate in all CSH events that occur during their stay, including our Friday seminars series. At the end of the program, each intern will have the opportunity to give a final presentation of their results to CSH researchers.

The objective of the CSH internship program is to give students the opportunity to be a part of a world-class research group, to gain hands-on experience with academic research, and to contribute to the group's ongoing research agenda. You will learn about complexity science, experience working in an international research institute, and have a chance to explore Vienna.

How to apply

Please complete the internship application form, found here:
CSH Internship Application Form

You will need to upload your CV and provide text responses to the following:

- Describe any job experiences, coursework, hobbies, skills, degrees, certifications, or licenses that you have that might be relevant during this internship.
- Describe your vision as a young scientist. What problem(s) would you like to solve? If your interest is in data visualization, what do you hope to achieve with your work?
- Describe what interests you about a specific project and how it fits into your scientific vision. Describe how this internship could be useful towards realising your scientific (or other) goals.

We process your personal data in accordance with European privacy and data protection law (www.csh.ac.at/data-protection/).

Eligibility

Students of all academic levels are eligible to apply. The program is aimed at students with some quantitative background, such as in the natural or social sciences, technology, engineering, mathematics, economics, finance, or related fields. We encourage all students with an interest in complexity science to apply.

Funding

There is no funding available to support participation in the internship program. We are happy to support students who are accepted into the program in their applications for independent funding, for instance through the Erasmus+ program.

Overview of Projects:

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Project 1: Complexity Economics and the Green Transition

Recent research suggests that how well economic agents, such as banks, firms, or even countries perform is to a large extent determined by the structure of the networks in which they are embedded. These networks include supply chains that record different types of bilateral business ties between companies or networks of monetary flows between financial institutions. Economic and financial crises can then be understood by means of dynamically cascading non-equilibrium processes on such networks.

Based on the students skillset and prior knowledge we will define a research question in relation to our groups current agenda.

This year's focus will lie on the role of production networks in the green transition. Potential research questions explore leverage points to reduce carbon emissions or the restructuring of the production network in response to the green transition.

We offer a position for students with a background and research interests in finance, network science, physics, mathematics, economics or related fields.

Our research requires strong analytical skills and programming in Python, R or Matlab.

Prerequisites:

- Basic courses in mathematics
- Programming and (big) data analysis is welcome

Supervisors: Johannes Stangl, Jan Hurt, Tobias Reisch

Project 2: Collective Adaptation in the Political Sphere

The human ability to organize in adaptive collectives is likely one of the key elements of our species' success. Our ability to change our social structures and cognitive strategies depending on a particular problem allows us to cope with our turbulent world. Unfortunately, the rapidly increasing scale and complexity of our collectives potentially magnifies threats to our societies, which are difficult to understand and predict, including the spread of conspiracy theories, denial of facts, extreme polarization, and violent extremism. To shed light on these processes and outcomes, we need to better understand how networks of beliefs or opinions change over time on the individual and collective level, both because of internal dynamics and external influences.

One important arena in which we can investigate these processes is in the political sphere. Just as people are related to each other in social networks, individual and collective opinions are not isolated from each other - they are embedded into a network of adjacent opinions. For example, one political party might connect opinions of immigration to crime, while another party might connect immigration to positive economic development. The different ways in which opinions are connected to each other is one reason why it might be difficult to reach agreement or consensus about issues.

Besides opinions changing during political discourse, individuals in interest or partisan groups might not evolve their opinions in the same way. This discrepancy can have many outcomes. It might lead to more heterogeneous opinions inside groups or parties, individuals leaving the group, or the foundation of new groups.

To investigate these processes, we analyze textual data from political agents in the form of mainly parliament speeches and possibly interviews, newspaper articles, etc. In addition, we will collect poll data over long time spans to compare network structure of parties and political outcomes.

We offer an internship for advanced undergraduate students with a background in computational social science, (social) data science, political science, network science, economics, mathematics, or related fields of societal sciences with a strong affiliation to quantitative methods.

Prerequisites:

- Programming skills in Python
- Experience with data-acquisition or data-scraping
- Experience in Natural Language Processing is a plus

Supervisors: Mathias Angermaier, Henrik Olsson, Mirta Galesic

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Project 3: Visualizing Seshat Datasets

The CSH visualization team offers a unique opportunity to contribute to the dissemination of knowledge about global history. You will gain invaluable hands-on experience with a diverse dataset, collaborating closely with resident scientists, and engaging directly with the Seshat team led by Peter Turchin for firsthand learning and interaction.

Your project will focus on Seshat: Global History Databank which is a unique and extensive repository of historical and cultural information on social, political, economic, and cultural aspects of human history across civilizations and time periods. The general aims are to extract meaningful insights and patterns from this dataset and presenting them through visually engaging mediums.

As a visualization intern, your task is to conceptualize and craft innovative and informative visual representations that effectively communicate complex historical information to a wider audience. The resulting work can be included in your professional portfolio. We encourage the exploration of interactive web-based formats, although we remain open to discussing alternative formats that align with the project's objectives.

You aren't expected to have fully developed visualizations by the program's end; you can continue refining them with ongoing support post-program. However, you will be required to present a prototype showcasing your work's progress during the final week.

Prerequisites:

- Experience with datasets in CSV and Json formats
- Programming skills in creating visualizations

Supervisors: Liuhuaying Yang, Tobias Batik

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Project 4: Predicting Armed Conflict

While infamous wars like World War I are seemingly coherent, they are actually composed of a variety of events that have been clustered together by choice. How they should cluster is complicated because events may be instantaneous like an explosion but may result from years of building tension.

In previous work, we addressed this problem by developing a statistical approach for uncovering chains of related conflict events. Our approach connects events in a way that highlights plausible and potentially hidden mechanism and helps uncover and exclude causal links in conflict spread. In short, the chains of conflict events that we obtain present new objects for study including for the prediction of further conflict.

In this project, the intern will focus on applying machine learning and artificial intelligence algorithms to the patterns that we have identified from previous work. The ideal candidate will have programming experience and familiarity with GPU programming and facility with quantitative work.

Supervisor: Eddie Lee

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Project 5: The Twittersphere of Cannabis Use During Pregnancy

We offer a summer internship at the Complexity Science Hub Vienna to investigate the growing concern of cannabis use during pregnancy (CanPreg), a relatively unexplored area with significant potential impact on both mothers and babies. The increasing prevalence of misinformation on social media platforms has led to the dissemination of inaccurate advice regarding this topic, necessitating further research to quantify the volume of CanPreg-related posts on Twitter and identify patterns in the discourse. This project aims to collaborate with Daniel J. Corsi (University of Ottawa) and Márton Karsai (Central European University), building upon preliminary results [1, 2], which focused on the United States. The internship will seek to replicate these results in Canada, the UK, France, and Australia, addressing the following objectives:

OB1: Quantify the volume of cannabis-related posts on Twitter during pregnancy, identifying demographic, content, and sentiment patterns.

OB2: Investigate the correlations between the percentage of relevant tweets and demographics obtained from census data.

OB3: Identify new ideas and directions to enrich the scope of the research and its potential impact.

The intern will have the opportunity to contribute to a data science project that addresses a critical health concern, with potential for further development and publication in peer-reviewed journals. We invite motivated individuals with a passion for data science, public health, and social media analysis to apply for this opportunity to make a meaningful impact on understanding the Twitter discourse on cannabis use during pregnancy and its societal implications.

Prerequisites:

- Programming in Python (experience with pandas, geopandas, SBERT 3 is a plus)
- Experience working with large datasets

Advisor: Lisette Espín-Noboa

References:

1. Cresswell, L., Espin-Noboa, L., Murphy, M. S., Ramlawi, S., Walker, M. C., Karsai, M., & Corsi, D. J. (2022). The volume and tone of Twitter posts about cannabis use during pregnancy: protocol for a scoping review. JMIR Research Protocols, 11(3), e34421. https://doi.org/10.2196/34421
2. Espin-Noboa, L., Ramlawi, S., Karsai, M., & Corsi, D. J. (2023). The Twittersphere of Cannabis Use During Pregnancy. 9th International Conference on Computational Social Science (IC2S3)
- Abstract: https://bit.ly/CanPreg-abstract-IC2S2-23
- Handouts: https://bit.ly/CanPreg-handouts-IC2S2-23
- Poster: https://bit.ly/CanPreg-IC2S2-23
3. Reimers, N., & Gurevych, I. (2019). Sentence-BERT: Sentence Embeddings using Siamese BERTNetworks. Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing. https://arxiv.org/abs/1908.10084

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Project 6: Digital Disinformation Spreading

We live in an era of information abundance where it is becoming challenging to control and measure the accuracy of the content that spreads over the media. There are various forms of untruthful information, which, depending on their nature, can be categorized into several types, such as fake news, misinformation, and disinformation. The spreading of untruthful information is a complex process, often involving multiple media like online social networks, television, web portals, etc. Many scientific studies have examined the spreading of information regarding topics like election campaigns and Covid-19, through social media such as Twitter and Reddit. In this project we will study more recent events, like the war in Ukraine, and in addition to typically studied social media we will also consider information spreading through email which has not been really addressed before. The analysis will involve the application of various techniques from the areas of data science, network science, machine learning and natural language processing, so the candidates should have certain knowledge and interest in some of these fields.

Prerequisites:

- Analytical skills
- Programming skills (preferably in Python)

Advisors: Miroslav Mirchev, Fariba Karimi, and Bernhard Haslhofer