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ETH Search & Find using AI - Project Outline

Andreas Opedal, Daniel Garellick and Giulia Lanzillotta

1. Introduction
2. Building the graph
3. Querying the graph
4. Conclusion

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09. Mai. 2018: Further confirmation of quantum mechanics

Nowadays, it is accepted among physicists that Albert Einstein was wrong in his sc
mechanics. This was also confirmed by the Big Bell Test involving over 100,000 pe
in November 2016. →

Quantum Mechanics – Optical Materials Engineering Laboratory ...

Introduction to **Quantum Mechanics** for Engineers. Some information below may change, please check the website for updates: ... →

Quantum Mechanics 1 – Institute for Theoretical Physics | ETH Zurich

Fall Semester 2017, ETH Zurich. This course is an introduction to **Quantum**

data science

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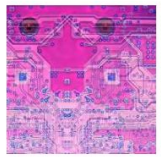
31. Jan.. 2019: ETH Zurich promotes data science research

Intelligent data science approaches are changing science, the economy and society. In a new interdisciplinary initiative, ETH researchers from the fields of mathematics, computer science and information technology are therefore increasingly dedicating themselves to the foundations of data science. →



07. Dez.. 2017: Innovative data science harnessing the spirit of Japanese poetry

ETH Lausanne and ETH Zurich's Swiss Data Science Center is off to a successful start. In September, scientists at the Center launched their open source platform Renga. First research projects have been chosen. →

20. Feb.. 2020: Eleven grand challenges in single-cell data science

In a review paper published by *Genome Biology*, researchers from the group of Niko Beerenwinkel together with experts from across the world compiled the state of knowledge in the rapidly emerging field of single-cell data science - and identified the grand challenges in analysing the massive data that results from the booming of high-throughput single-cell sequencing technology. →

09. Feb.. 2017: Postdoctoral position in Big Data and Data Science

We are looking for a highly motivated postdoctoral fellow in the area of Big Data and Data Science with a particular focus on Social Mining within a EU funded project. The project aims to establish a Social Mi-

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Quantum Mechanics.

Quantum mechanics is the field of

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- Bachelors courses
- Masters couses

Relevant Research Lab (1)
short description of lab

Relevant Research Lab (2)
short description of lab

Course Webpage
short description of course

Andreas Krause

Empfehlung

Name	Telefon	E-Mail	Gebäude	Organisation
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Andreas Krause | Learning & Adaptive Systems Group

Andreas Krause is a Professor of Computer Science at ETH Zurich, where he leads the Learning & Adaptive Systems Group. He also serves as Academic ... →

Learning & Adaptive Systems Group |

We are part of the Institute for Machine Learning at the Department of Computer Science of ETH Zurich. The group is led by **Andreas Krause**. Our research is in ... →

Prof. Andreas Krause receives ICML Test of Time Award ...

Pauline Lüthi | 02.07.2020. The International Conference on Machine Learning award committee has recognized Prof. **Andreas Krause** and his collaborators ... →

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Tutorial on Safe Reinforcement Learning

Oct 1, 2018 .. Felix Berkenkamp, **Andreas Krause**. Safe Controller Optimization for Quadrotors with Gaussian Processes. F. Berkenkamp, A. P. Schoellig, ... ↓

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Near-Optimal Sensor Placements in Gaussian Processes: Theory ...

c 2008 **Andreas Krause**, Ajit Singh and Carlos Guestrin. Page 2. KRAUSE, SINGH AND GUESTRIN a fundamental task. One approach is to ... ↓

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Submodular Function Maximization

Submodular Function Maximization. **Andreas Krause** (ETH Zurich). Daniel Golovin (Google). Submodularity1 is a property of set functions with deep theoretical ... ↓ 2012

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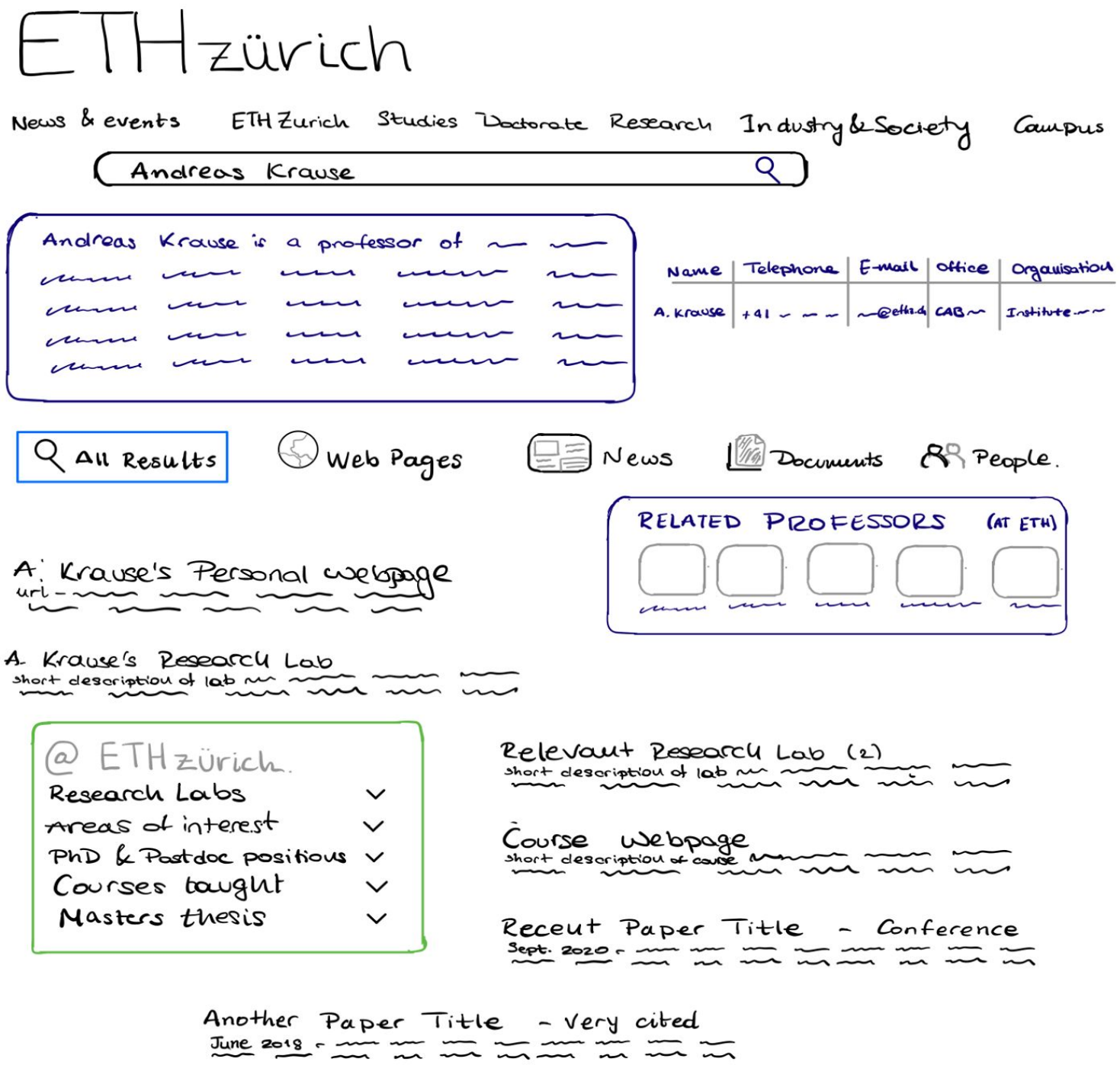
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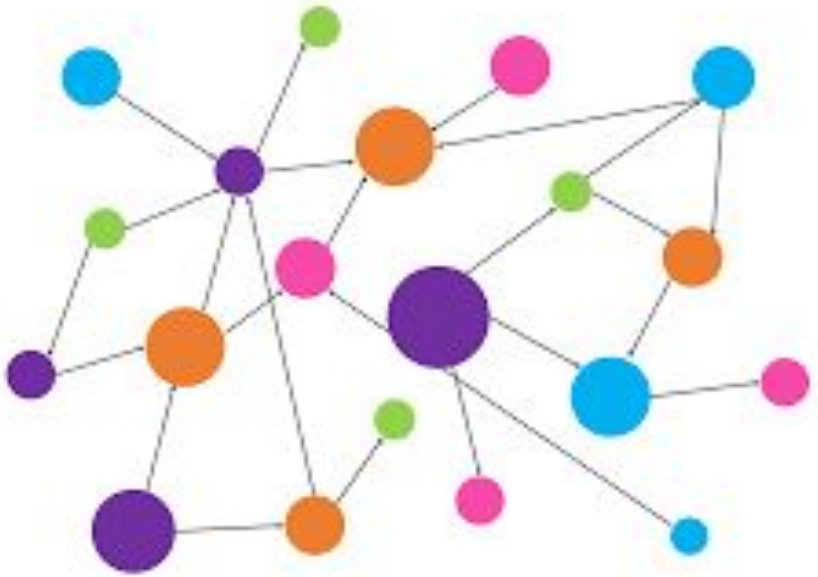
How to achieve this?

1. Build a graph upwards from the data we have (unstructured text, metadata, professor info…)



2. Query the graph by creating the appropriate relations, entry points and functions

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Building the graph - data

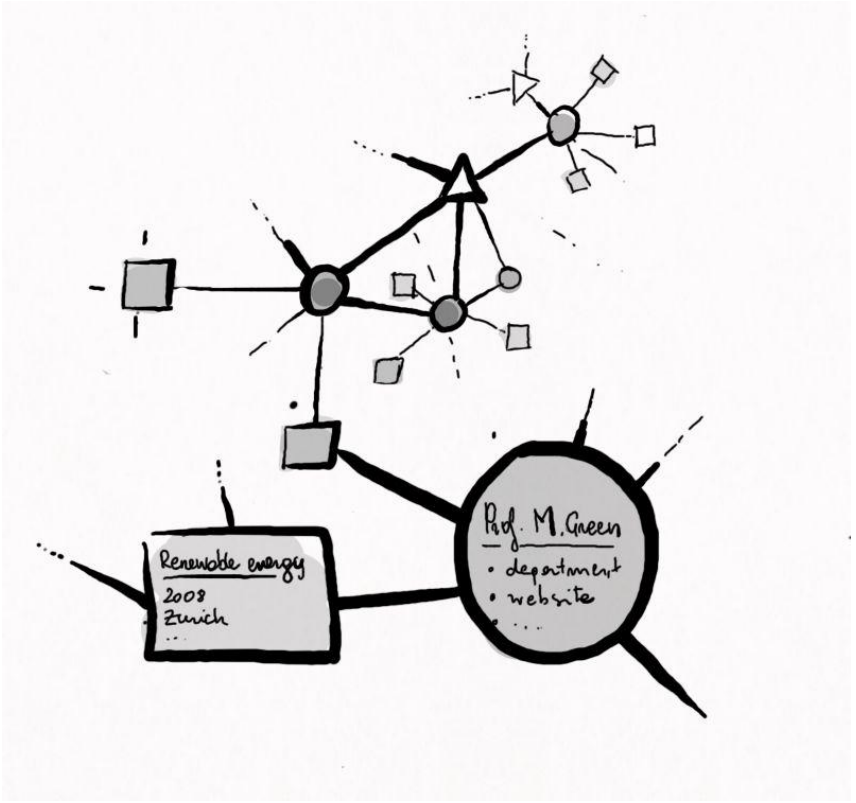
Main Data Sources:

- Research Collection Publication 2008-2018.tsv
- ETH Research Abstract
- ETH Professor list .xlsx (and possibly other academic staff?)
- Professor websites

Main Features to be used:

- Publication author(s), title, date & abstract
- Professor name, department & research group

Building the graph - metadata (Research Collection)



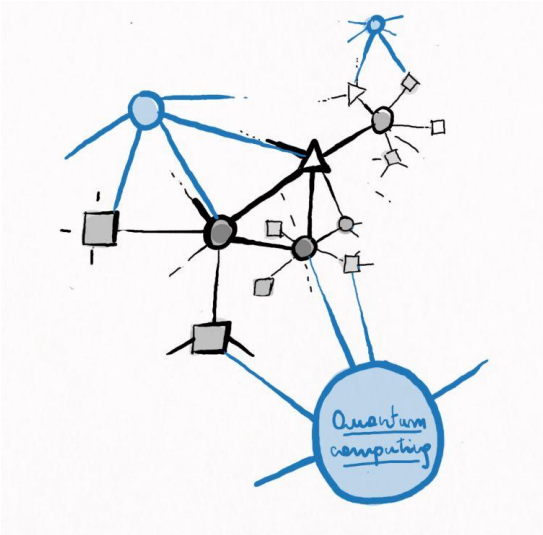
Meta Data Source: Research Collection Publication 2008-2018.tsv

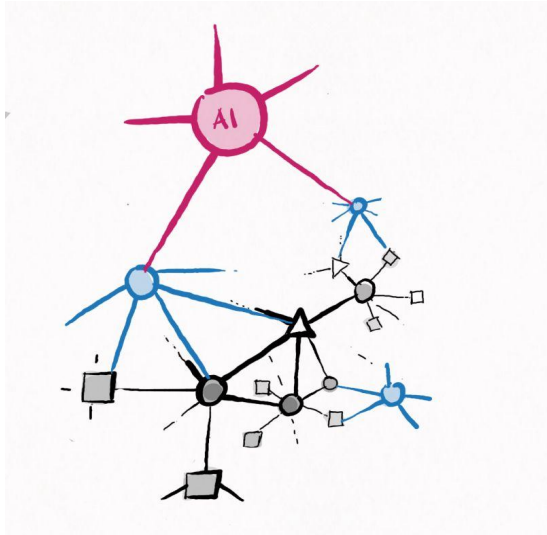
Main Features to be used: Publications, professors and departments

Building the graph - automatic graph enrichment

Goal: Enriching the graph by topic modeling

- Using **abstracts** to extract publication topics
- Note: Topics will after this step be represented by an ordered list of likely words to occur in topic
- Potential for cutting-edge ML and NLP
- Connect topics to publications in graphs, in order to be able to link topics with publications, professors and ETH research areas
- Possibly hierarchical structure: Topic belongs to Research Area which belongs to Research Field etc..





Building the graph - website data example

Website data is unstructured and has high variation

Research

Mathematical Statistics

Workshop High-dimensional problems in Statistics, September 2011

Slides of the Wald Lectures 2016: First lecture, Second lecture, Third lecture

Slides of the van Wijngaarden Soiree 2016: Some bias and a pinch of variance

Slides of Lecture at Kick-off-Conference Laboratoire de Probabilités, Statistique et Modélisation 2018: Some concentration results for the Lasso

Slides of 1st Lecture at Georgia Tech (August 31, 2018): Sharp oracle inequalities for non-convex loss

Slides of 2nd Lecture at Georgia Tech (September 4, 2018): Compatibility and the Lasso

Slides of 3rd Lecture at Georgia Tech (September 6, 2018): The debiased Lasso

Slides of Markov lecture (November 5, 2018): Adaptive estimation using regularized empirical risk

Slides of MAD+ lecture (April 29, 2020): Total variation regularization

Slides of one world probability lecture (May 21, 2020): Learning with total variation regularization

Some keywords and phrases

adaptive estimation
classification
empirical processes
entropy
high-dimensional data
lasso
M-estimators
non- and semiparametric statistical models
penalties
probability inequalities for stochastic processes
sieves

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Bio

Andreas Krause is a Professor of Computer Science at ETH Zurich, where he leads the Learning & Adaptive Systems Group. He also serves as Academic Co-Director of the Swiss Data Science Center. Before that he was an Assistant Professor of Computer Science at Caltech. He received his Ph.D. in Computer Science from Carnegie Mellon University (2008) and his Diplom in Computer Science and Mathematics from the Technical University of Munich, Germany (2004). He is a Microsoft Research Faculty Fellow and a Kavli Frontiers Fellow of the US National Academy of Sciences. He received ERC Starting Investigator and ERC Consolidator grants, the Deutscher Mustererkennungspreis, an NSF CAREER award, the Okawa Foundation Research Grant recognizing top young researchers in telecommunications as well as the ETH Golden Owl teaching award. His research on machine learning and adaptive systems has received awards at several premier conferences and journals, including the ACM SIGKDD Test of Time award 2019 and the ICML Test of Time award 2020. Andreas Krause served as Program Co-Chair for ICML 2018, and is regularly serving as Area Chair or Senior Program Committee member for ICML, NeurIPS, AAAI and IJCAI, and as Action Editor for the Journal of Machine Learning Research.

Building the graph - website data

Goal: Incorporate website data into graph in order to

a) Validate the topics extracted by Machine Learning
b) Add relevant information, e.g. on courses, masters theses and open PhD positions as well as biography

- Will add redundant information and new relevant information
- Again: unstructured data, leading to missing values in graph
- Topics and Area matching - infer topic names from professor biographies

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Querying the graph

What can we ask to our enriched data ?

Goal: develop functions that make the data easily accessible.

Our suggestions:

- **ETH research** info
- **relevant** info: `Q → List<N>` based on matching criteria
- **related** info: `List<N> → List<N>` based on similarity criteria
- **ordering** info: `List<N> → Ordered List<N>` based on ordering criteria
- question answering

Querying the graph - ETH research info

Examples of ETH research info (first iteration goal)

- (active) research areas
- (hot) topics
- recent/popular publications
- research groups publication indices

Insights to gain:

Do the hot topics in ETH labs match the hot topics in the search logs?

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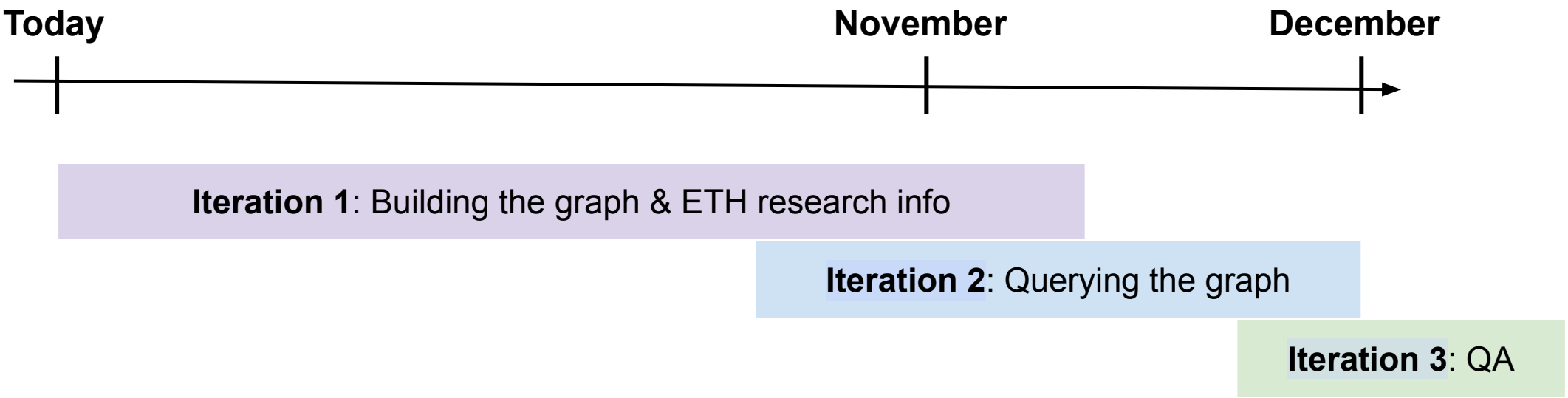
Conclusion

Tentative Project Timeline:



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Questions?