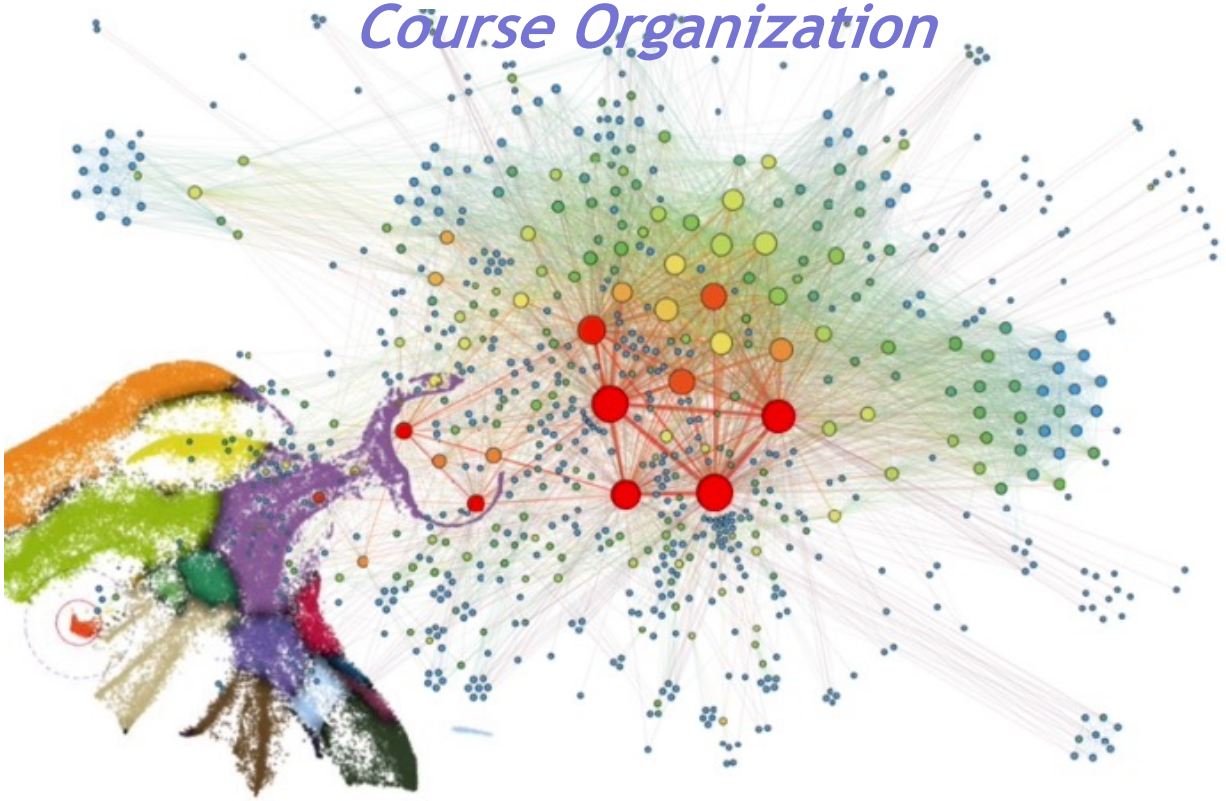
(High-dimensional and Relational) Data Visualization

Course Organization



dr. Tamara Mchedlidze

prof. dr. Alexandru (Alex) Telea

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Utrecht University, the Netherlands

Course info: https://webspace.science.uu.nl/~telea001/DataVis/

Introduction - Instructors

Tamara Mchedlidze (Mtsentlintze)

- PhD in graph drawing (NTUA Athens, 2012)
- PostDoc in network visualization (KIT Karslruhe, 2012-2020)
- assistant professor (UU Utrecht, since 2020)
- research: graph drawing (theory, practice, ML), applications of datavis in humanities
- check: https://evm.science.uu.nl/

https://www.uu.nl/staff/TMtsentlintze1

Alex Telea

- PhD in scientific visualization (TU Eindhoven, 2000)
- assistant professor in visualization (TU Eindhoven, 2000-2007)
- professor in multiscale visual analytics (RUG, 2007-2019)
- professor in visual data analytics (UU, since 2019)
- research: visual analytics, shape analytics, machine learning

http://www.staff.science.uu.nl/~telea001

Alister Machado dos Reis (tutorials)

- Bachelor in Computer Science (UFRGS, Brasil, 2017)
- Master's in Data Science (INP, Grenoble, 2017)
- Software Engeneer (Google Brasil, 2018-2021)
- PhD student (UU Utrecht, since 2021)
- research: interactions between Visualization and Reinforcement Learning

https://www.uu.nl/staff/AMachadodosReis

For *whom* is this course

- (under)graduate students in the MSc phase
- interested to learn in depth algorithms and methods for data visualization

What you need to know *before*

- a programming language (C, C++, Python, Java, C#)
- data/software management (platforms, tools, scripting, etc)
- background in math (linear algebra, calculus, optimization, statistics)
- knowledge of algorithms and computational complexity
- fundamentals of visualization and/or graphics

Course Structure

Lectures

• 7 lecture weeks
• communicate and illustrate theory, techniques, methodology
• present examples
• interactive setting: slides, questions to**from audience** (!)

Tutorials

• develop a tool for relational, high-dimensional data visualization
• work in groups (1..3 students); **groups of 2** are encouraged
• assignment is online (assignment -> Overview)
• work on the assignment as the course progresses (25% of the grade, more later)

Feedback

• global, during lectures
• per-group, from lecturers, upon submission of progress reports

Course Structure

Grading (more later)

- 25% Process
- 25% Final project presentation
- 50% Final project deliverable

Course Outline

Module 1: **Introduction**

Module 2: **Tree visualizations**

Module 3: **Visualization of general graphs**

Module 4: **Visualization of directed graphs**

Module 5: **Visualization of clustered/multilayer networks**

Module 6: **Low dimensional data visualization**

Module 7: **High dimensional data visualization**

Note: A module is not 1-to-1 to one lecture

Course Schedule

Week	Date	Content	Lecturer
6	February 8	Introduction to Network Visualization	Tamara
7	February 13	Tutorial 1: Read and draw a graph	Alister
	February 15	Tree Visualizations	Tamara
8	February 20	Tutorial 2: Extract and draw a tree	Alister
	February 22	Visualization of general graphs	Tamara
9	February 27	Tutorial 3: Implement force-directed	Alister
	March 1	Visualization of hierarchical graphs	Tamara
10	March 6	Tutorial: Implement hierarchical layout	Alister
	March 8	Lecture-free week	
11	March 13	Tutorial: additional task	Alister
	March 15	Visualization of multilevel networks	Tamara
12	March 20	Tutorial: multilevel and bundling	Alister
	March 22	High-dimensional data visualization: basics	Alex
13	March 27	Tutorial	Alister
	March 29	High-dimensional data visualization: advanced	Alex
14	April 3	Final Presentations	Students
	April 5	Final Presentations	Students

Note: MSTeams -> General -> Files

Assessment

Practical assignment

Design and implement a system for the visualization for relational and high-dimensional data

1. Progress report updates (25% of the grade)

- describes implementation choices, parameters of the algorithms, presents output visualizations, qualitative and quantitative evaluation of the visualizations
- submit progress of the report every week - same updated document
- use github for collaborative work both for code and progress report
- submit progress report every week (on Monday) to MSTeams (Tutorials -> Files)
- we grade: consistency, quality, and completeness

2. Final project deliverable (50% of the grade)

- PDF of the final report (completeness of the assignments and explanations, quality of writing)
- GitHub repository with code (not graded separately, but must work to pass course)
- Readme + built instruction

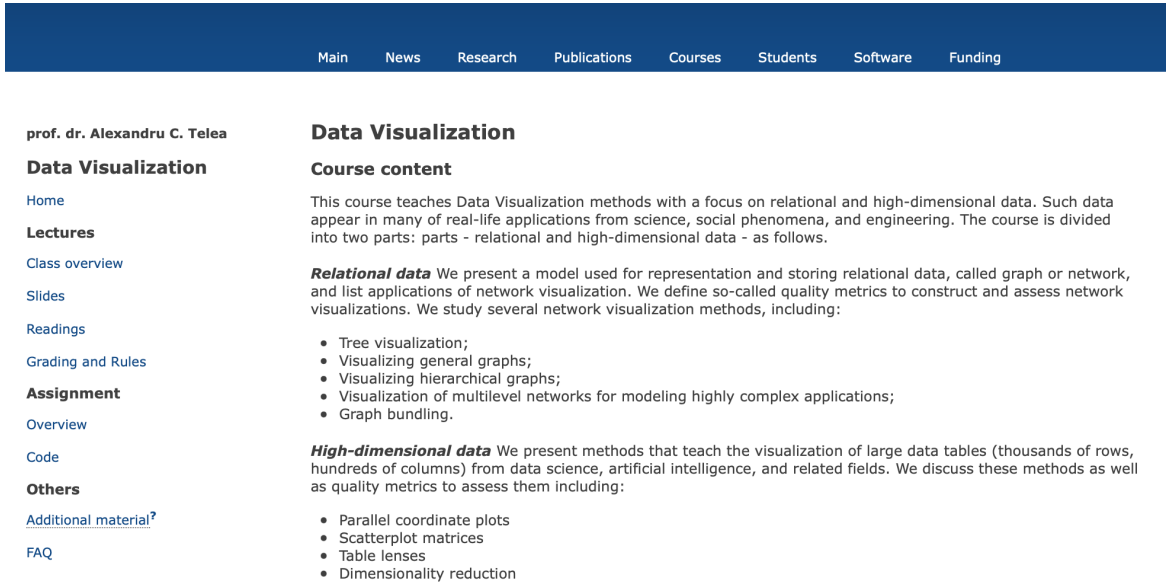
3. Final presentation (25% of the grade)

- present orally your system
- clarity and structure of the presentation, quality of the slides, engagement with the audience, addressing questions

Communication Channels

Course webpage

- slides (as the course progresses)
- recommended books/articles
- datasets
- sample code fragments
- assignment description
- grading rules
- FAQ

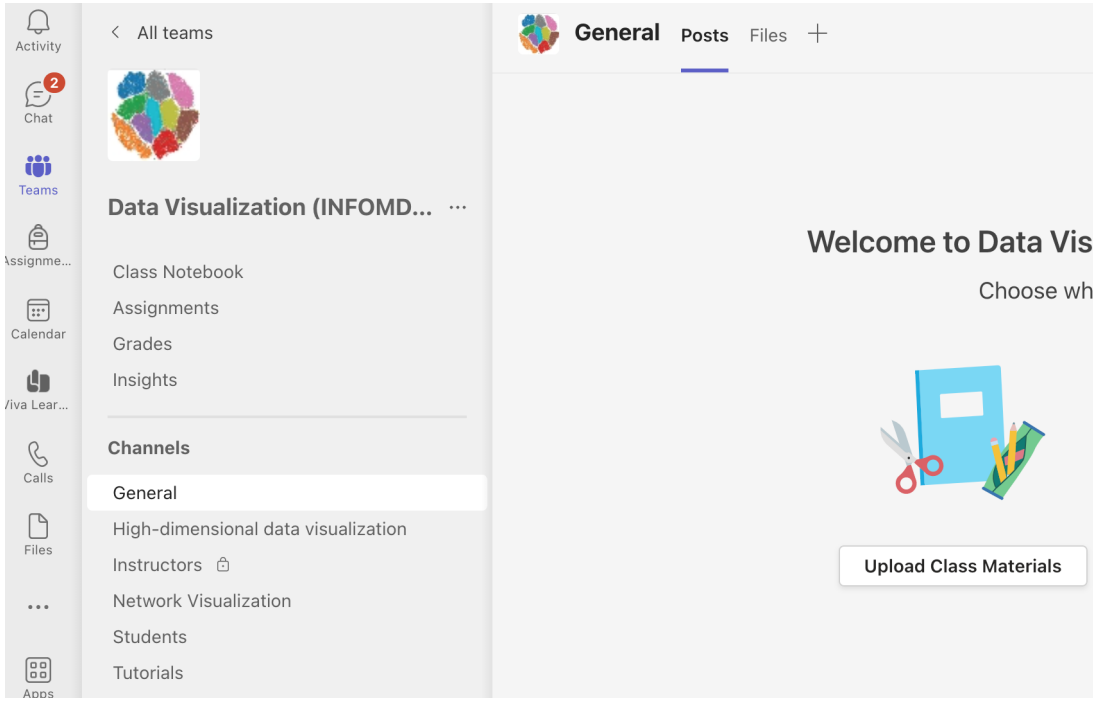


Course info: https://webspace.science.uu.nl/~telea001/DataVis/

Communication Channels

MSTeams

- link in blackboard – please request access
- General : announcements and questions about organizational matters
- High-dim data vis : questions about high-dim vis topics
- Net Vis : questions about network visualization topics
- Students : communication among the students, can help you to find project partner
- Tutorials : questions about assignments



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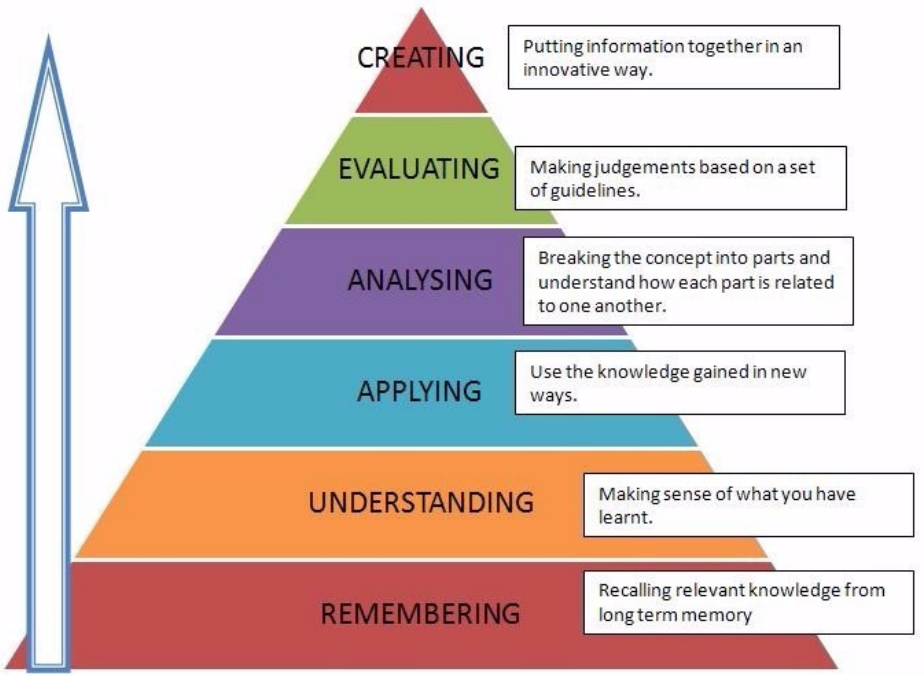
Learning Goals

- Have an overview of the state-of-the art visualization methods for relational and high-dimensional data (Remember)
- Be able to explain the functionality of these methods (Understand)
- Implement the methods in your programming language of choice (Apply)
- Parametrise the methods for a range of data sets (Apply)
- Assess the results of the constructed visualizations (Analyse, Evaluate)
- Present and motivate all taken choices (Analyse, Create)



Bloom's Taxonomy for Learning Outcomes

Additional Remarks

Competences assumed you have (and develop further)

Coding

- you need to be able to **program** (well)!!!
- lecturer is **not assumed** to debug your source code

Communication

- describe a problem/question **correctly**, **compactly**, and **technically** (“it does not work, what to do?” is not a good example ☺)

Reporting

- your final report should be at the level of an **industry white paper / tech report / scientific publication**
- well structured, complete, coherent, with clear math notations, references
- **illustrate** all you do by graphs, charts, snapshots

Additional Remarks

Be present!

- lectures give **detailed explanation** of the methods you need to implement
- tutorial sessions give opportunity to **ask questions** and **anticipate challenges**

Be proactive!

- ask **questions** during lectures!
- provide assignment progress **reports**
- do read all information on course **website**

Watch the time!

- make sure you progress **continuously** with the assignment
- report blockers ASAP!

Last but not least: Have fun!