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## PRACTICAL INFORMATIONS

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**Teachers**

Pierre VANDERGHEYNST  
Pascal FROSSARD  
Andreas LOUKAS  
Michaël DEFFERRARD  
Volodymyr MIZ

**Assistants**

Michaël DEFFERRARD  
Volodymyr MIZ  
Effrosyni SIMOU  
Eda BAYRAM

Benjamin RICAUD

Nicolas ASPERT  
Clément VIGNAC  
Guillermo JIMENEZ  
Nikolaos KARALIAS

# Team



Pierre  
Vandergheynst



Pascal  
Frossard



Andreas  
Loukas



Michaël  
Defferrard



Volodymyr  
Miz



Effrosyni  
Simou



Eda  
Bayram



Benjamin  
Ricaud



Nicolas  
Aspert



Clément  
Vignac

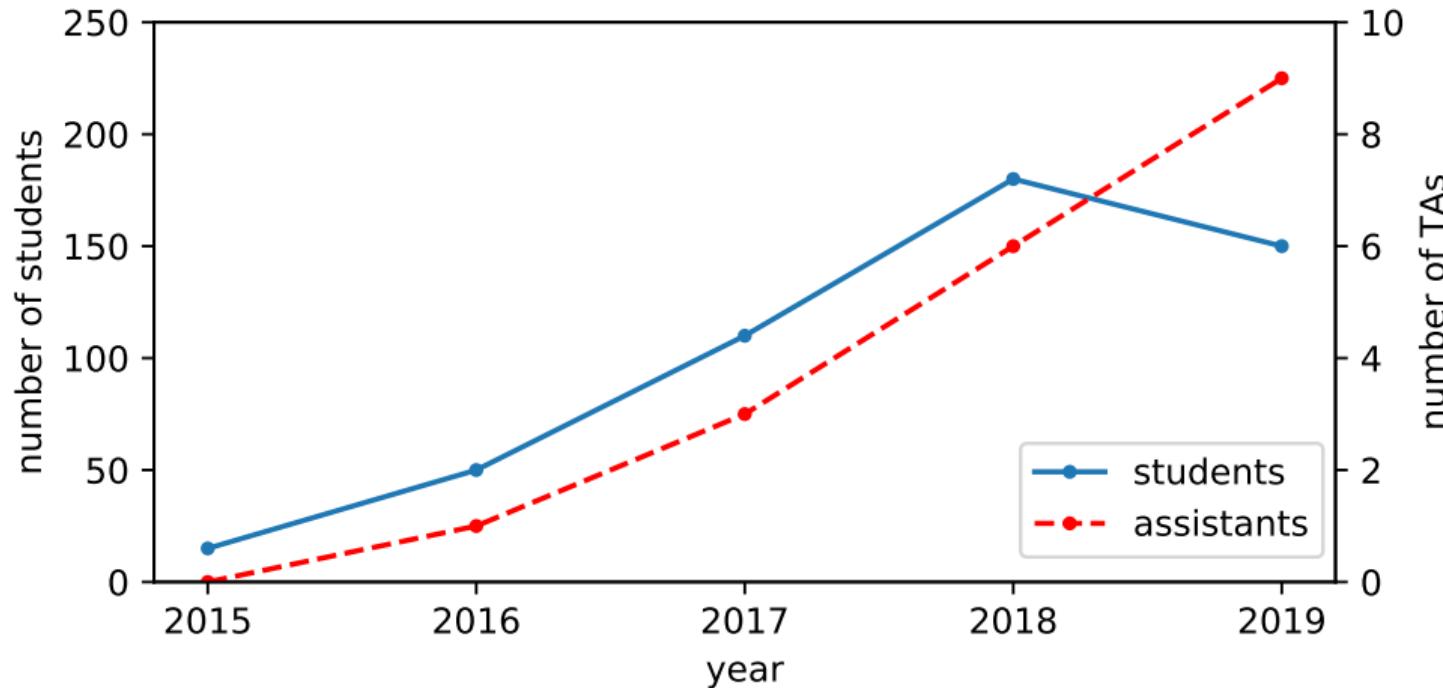


Guillermo  
Jimenez



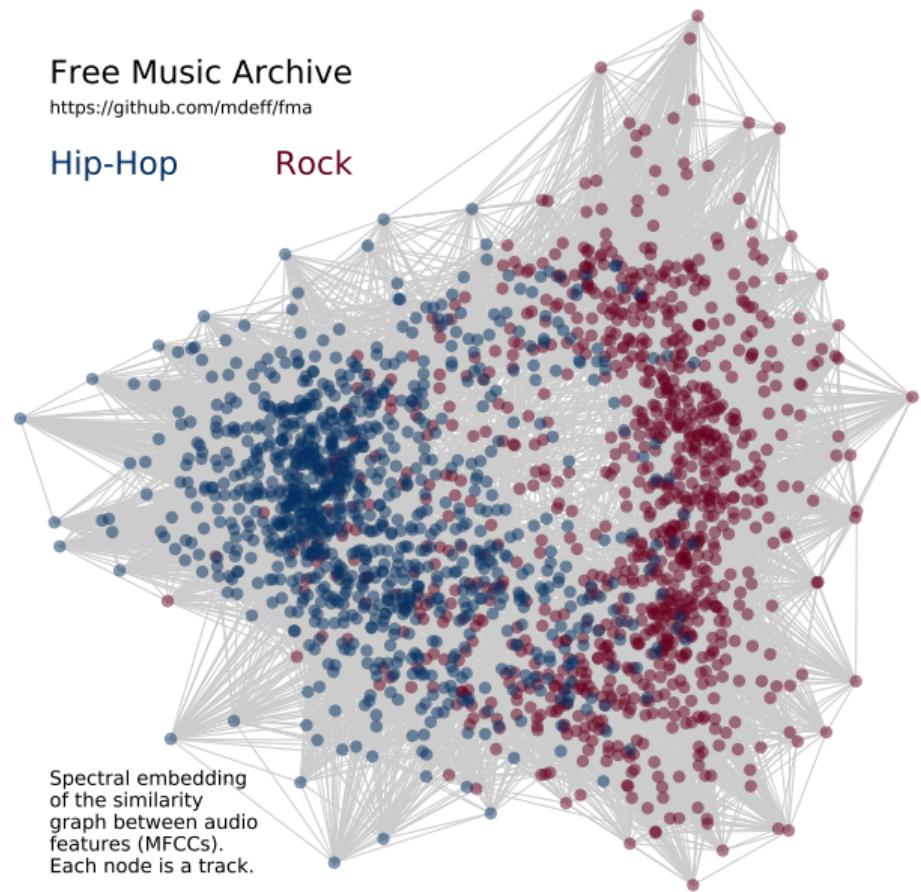
Nikolaos  
Karalias

## Enrollment

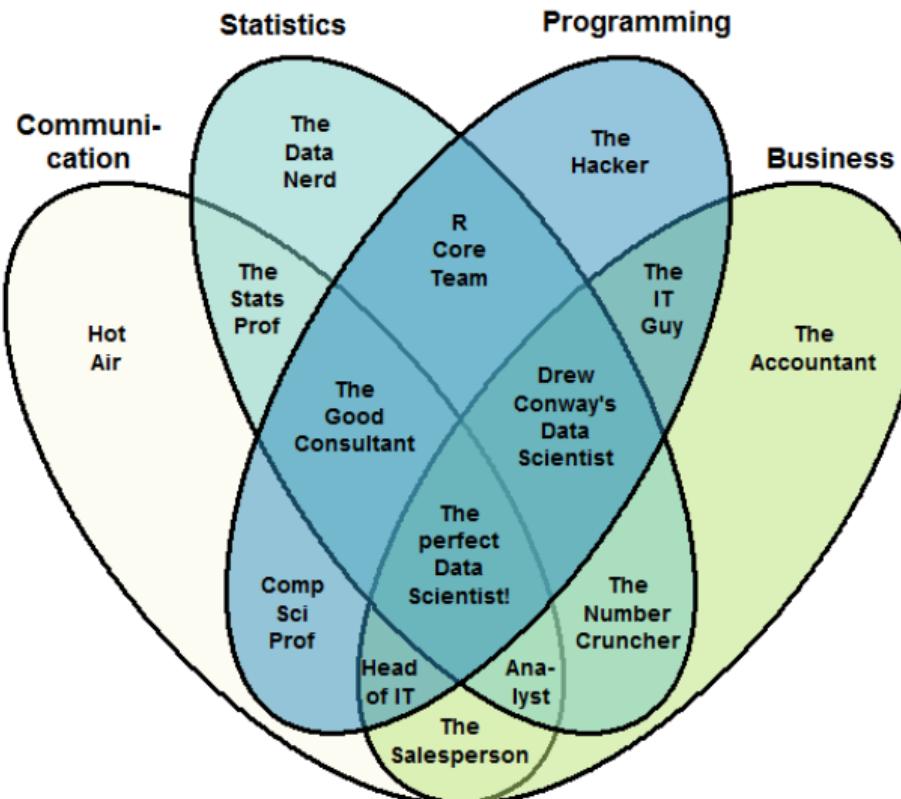


# Content: A Network Tour of Data Science

1. Network Science
2. Spectral Graph Theory
3. Graph Signal Processing
4. Machine Learning with Graphs



# Content: A Network Tour of Data Science



# Organization

## Theory & practice

**Lectures** theory and tools to deal with networks and network data

**Lab sessions** application of the tools to real-world data

Sessions on Tuesdays (10:15 to 12:00, CE2) and Wednesdays (10:15 to 12:00, CO2)

## Course support

- ▶ your notes
- ▶ lecture slides (available on Moodle)
- ▶ research papers and textbooks referenced in the slides

# Schedule

(tentative, updated on Moodle)

Date	Topic	Instructor	Room	Deadline
17.09	Introduction	Vanderghenst, Defferrard	CE2	
18.09	Graph theory basics	Frossard	CO2	
24.09	Installation & basics		CE2	
25.09	Random networks	Frossard	CO2	
01.10	Scale-free networks	Frossard	CE2	group registration
02.10	<a href="#">Assignment 1: network properties &amp; models</a>		CO2	
08.10	<a href="#">Assignment 1: network properties &amp; models</a>		CE2	
09.10	Network formation models	Frossard	CO2	
15.10	<a href="#">Assignment 1: network properties &amp; models</a>		CE2	assignment 1
16.10	Elements of spectral graph theory	Loukas	CO2	
22.10	Unsupervised learning with graphs: spectral clustering	Loukas	CE2	
23.10	<a href="#">Assignment 2: spectral, GSP, GNN</a>		CO2	
29.10	<a href="#">Assignment 2: spectral, GSP, GNN</a>		CE2	
30.10	Unsupervised learning with graphs: dimensionality reduction	Loukas	CO2	
05.11	Regularization on graphs with graph signal processing	Loukas	CE2	

# Schedule

(tentative, updated on Moodle)

06.11	Assignment 2: spectral, GSP, GNN		CO2
12.11	Supervised learning on graphs with deep learning: part I	Defferrard	CE2
13.11	Supervised learning on graphs with deep learning: part II	Defferrard	CO2
19.11	Assignment 2: spectral, GSP, GNN		CE2 assignment 2
20.11	Project		CO2
26.11	Project		CE2
27.11	Network epidemics	Frossard	CO2
03.12	Visualization	Miz	CE2
04.12	Project		CO2 project summary
10.12	Project		CE2 peer review
11.12	Project		CO2
17.12	Project		CE2
18.12	Project		CO2
10.01	Handle project report and github repository		report and repository
21.01	Project presentation		
22.01	Project presentation		slides

# Deadlines

(tentative, announced on Moodle)

Oct 1 form groups of four

Oct 15 handle assignment 1 (network properties & models)

Nov 19 handle assignment 2 (spectral, GSP, GNN)

Dec 4 handle project summary for peer-review

Dec 10 handle peer-review report

Jan 10 handle project report and github repository

Jan 21 project presentations

## Practical sessions

Apply the material learned in class in a Data Science context.

During the labs, we will:

- ▶ Demo tools, e.g., how to manipulate a graph in Python.
- ▶ Explain the assignments and give directions.
- ▶ Answer questions about the assignments and project.

We expect you to:

- ▶ Bring your laptop.
- ▶ Work outside the hours on the assignments and project.

# Tools: Python scientific stack

To be installed with conda.

- ▶ git: version control system
- ▶ Python: programming language
- ▶ Jupyter: interactive computing
- ▶ NumPy:  $n$ -dimensional arrays
- ▶ SciPy: scientific computing
- ▶ matplotlib: visualization
- ▶ pandas: data analysis
- ▶ NetworkX: network science
- ▶ graph-tool: network science
- ▶ gephi: graph visualization
- ▶ PyGSP: graph signal processing
- ▶ scikit-learn: graph embedding
- ▶ PyTorch: deep learning

## Evaluation

Joint evaluation of theoretical and practical skills through assignments and a project.

Two parts:

1. Guided with two assignments that follow the lectures.
2. Open ended project.

## Grading

**assignments** 50% for acquiring the course material in a structured way

**peer-review** 10% for giving critical feedback

**project** 40% for being creative and able to understand data, i.e., Data Science

# Assignments

1. Template notebook with instructions given on GitHub.
2. Multiple weeks to complete.
3. Lab sessions to ask questions.
4. Completed notebook to be handled on Moodle.
5. Solutions posted on GitHub.
6. Grades given on Moodle.

Topics that follow the lectures, with a Data Science taint:

1. Network properties & models
2. Spectral Graph Theory, Graph Signal Processing, Graph Neural Networks

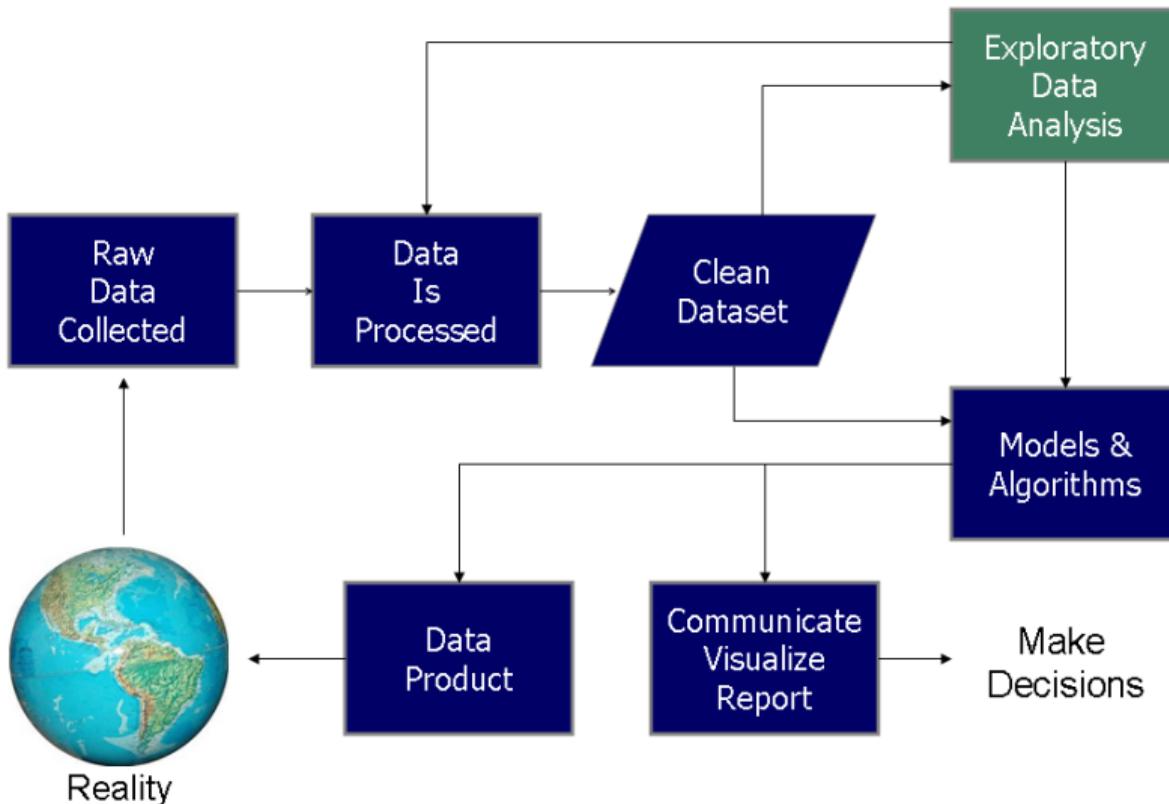
# Project

More information later in the semester.

Tell us a data story based on the course material!

1. Form teams of four and choose a project.
2. Write a summary and get critical feedbacks from peers.
3. Handle a report and a git repository with code.
4. Impress us in a presentation!

# Data science process



# Some projects from 2018

more at [https://github.com/mdeff/ntds\\_2018](https://github.com/mdeff/ntds_2018)

The image displays a 3x3 grid of project posters, each representing a different data science application. The projects are:

- Spammer... Catch me if you can**: A network graph visualization titled "TEAM 20". It features a complex web of nodes and connections, with a prominent cluster of nodes in the center. Below the graph, the text reads: "Spammer... Catch me if you can", "TEAM 20", "Hedi Fendri - Paul Jahn", "Christina Hartmann - Nguyen Minh Nguyen".
- A Netflix Tour of Data Science**: A poster featuring a collage of movie posters from the Netflix catalog. The main title is "A Netflix Tour of Data Science" and the subtitle is "Film Suggestion by Diffusion on Graphs". Below the collage, it says "Avignon Edwige - Fourcade Pierre - Nguyen Kenneth".
- Wiki**: A poster for "Wikipedia Analysis Using a Keyword Based Graph". It features the word "Wiki" in large, stylized red letters. Below it, the text reads: "Wikipedia Analysis Using a Keyword Based Graph", "Project – A Network Tour of Data Science", "Marc GLETTIG", "Mathias MINOIR", "Yves RYCHNER", "Charles TROTIN", "Ecole Polytechnique Fédérale de Lausanne", "23/01/2019", "NTDS 2018".
- Voting patterns in the Swiss National Council**: A poster showing a photograph of the Swiss National Council chamber. The text reads: "Voting patterns in the Swiss National Council", "Through a network analysis", "Steve Webster", "Domenec Valls", "Yannick Dufour", "Diego Beltramini", "EPFL ECOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE".
- Finding Continents from a Flight Routes Network**: A poster featuring a map of the world with flight routes overlaid. The text reads: "Finding Continents from a Flight Routes Network", "EPFL - Network Tour of Data Science", "D. Bouaziz, P. Desiraju, A. Duvallet, A. Vandenbroucke".
- How to Beat Terrorism Efficiently**: A poster with a background of network graphs and geometric shapes. The text reads: "How to Beat Terrorism Efficiently", "Identification of Set of Key Players in Terrorist Networks", "Marco Pietro Abrate", "Natalie Bolan", "Shahow Kakavandy", "Jangwon Park".
- An exploratory study on the brain dysconnectome**: A poster showing two brain network graphs. The text reads: "An exploratory study on the brain dysconnectome", "Claudia Bigoni", "Giorgia Giulia Evangelista", "Emeline Müller", "Joan Rue", "Professors: Prof. Pascal Frossard", "Prof. Pierre Vandergheynst", "EPFL ECOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE", "Unil UNIL | Université de Lausanne".
- PROJECT 2018: A Network Tour of Data Science**: A poster for the 2018 competition. It shows a soccer stadium filled with spectators. The text reads: "PROJECT 2018: A Network Tour of Data Science", "A Network Analysis", "The 2018 FIFA World Cup", "TEAM 5", "Maxence DRAGUET", "Robert INJAC", "Yannick KLOSE", "Manana LORTKIPANIDZE".
- NTDS TEAM 52: Mood Changing Playlist Generator**: A poster featuring a woman smiling with musical notes floating around her head. The text reads: "NTDS TEAM 52: Mood Changing Playlist Generator", "Jawad Imtiaz Ahmed", "Reza Hosseini", "Emmanouil Jacobides", "Miguel Gomez Quintanilla".

# Online

Moodle, <https://moodle.epfl.ch/course/view.php?id=15299>

- ▶ slides
- ▶ official announcements
- ▶ grades
- ▶ discussion forum

GitHub, [https://github.com/mdeff/ntds\\_2019](https://github.com/mdeff/ntds_2019)

- ▶ assignments
- ▶ installation instructions
- ▶ projects
- ▶ tutorials

# Questions?