



OTTO
VON
GUERICKE

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Semester in OvGU
2015-2016

CONTENTS

- How to get into the program?
- Survival in Magdeburg
- Studying in OvGU
- Computer Science
- Mathematics
- Quadrocopters
- Questions

How to become a part of the program?

Before last year

- academic achievements and good reputacy (usually only best students go)
- participation in the earlier stages of the program (week-trips, 1,2-months' practices)
- attending lessons of German

At last year

- application to KM-stuff and getting permission
- collecting lots of documents
- multiple visits to the Embassy
- tickets to Germany!

ACCOMODATION

- apartment is like a flat
- with almost everything you need
- in walking distance to canteen and classes
- in IKUS building
- next to library and sport ground

Live ≠ evil

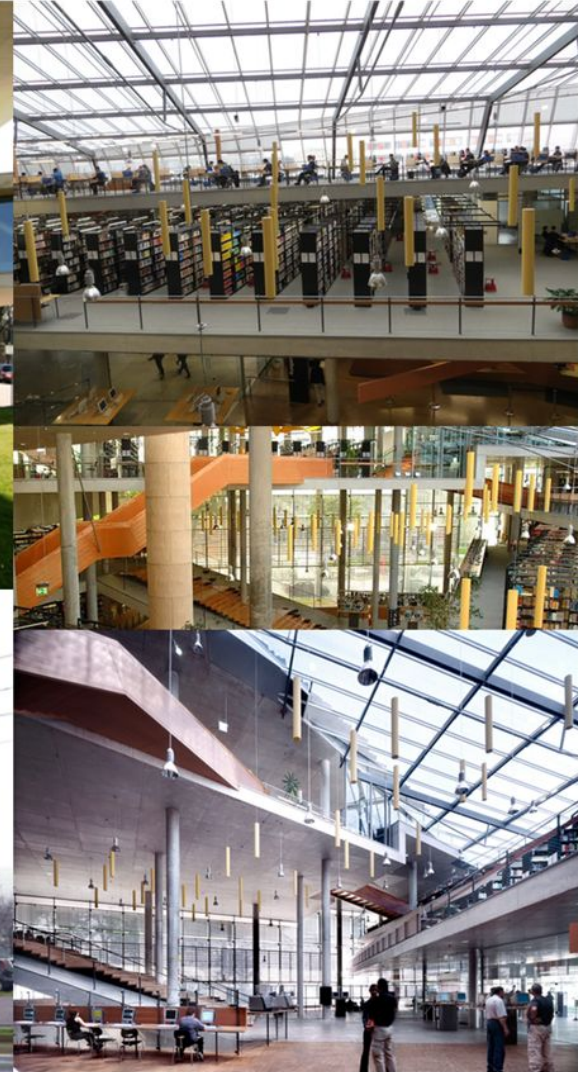


UNIVERSITY FACILITIES

- scholarship $\approx$ 15 your current scholarships
- cheap mensa (canteen) with tasty food
- large convenient library
- student card = free local transport
- free German classes for foreigners
- free sport classes
- IKUS parties

LIBRARY

- Books, PCs
- Wi-Fi
- Web-catalogue
- Ideal for studying
- 8-23h



ub.ovgu.de

SUBJECTS SELECTION

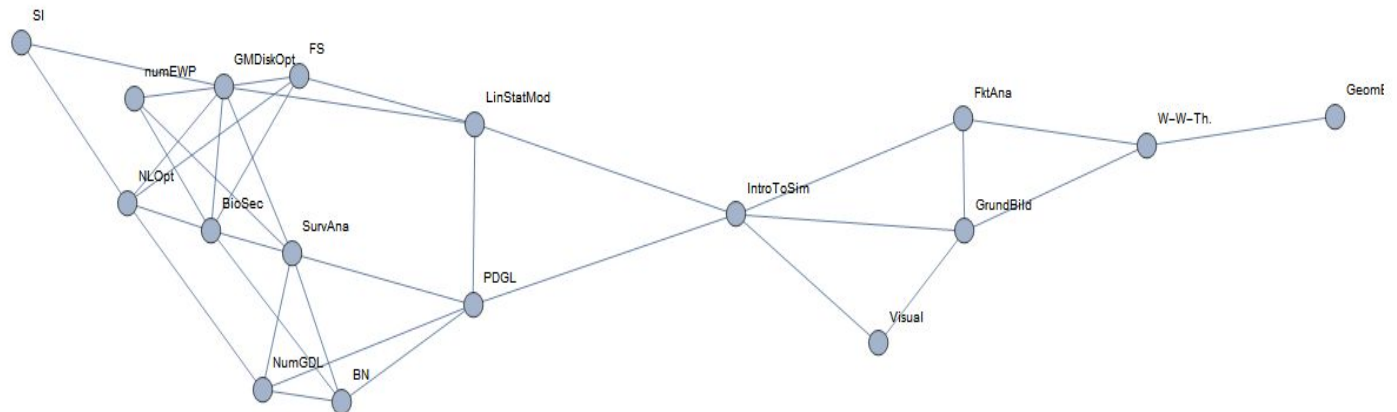
Given: list of all possible subjects by prof. Girlich

Find: interesting subjects with appropriate sum of points

Problem: intersections and windows in timetable

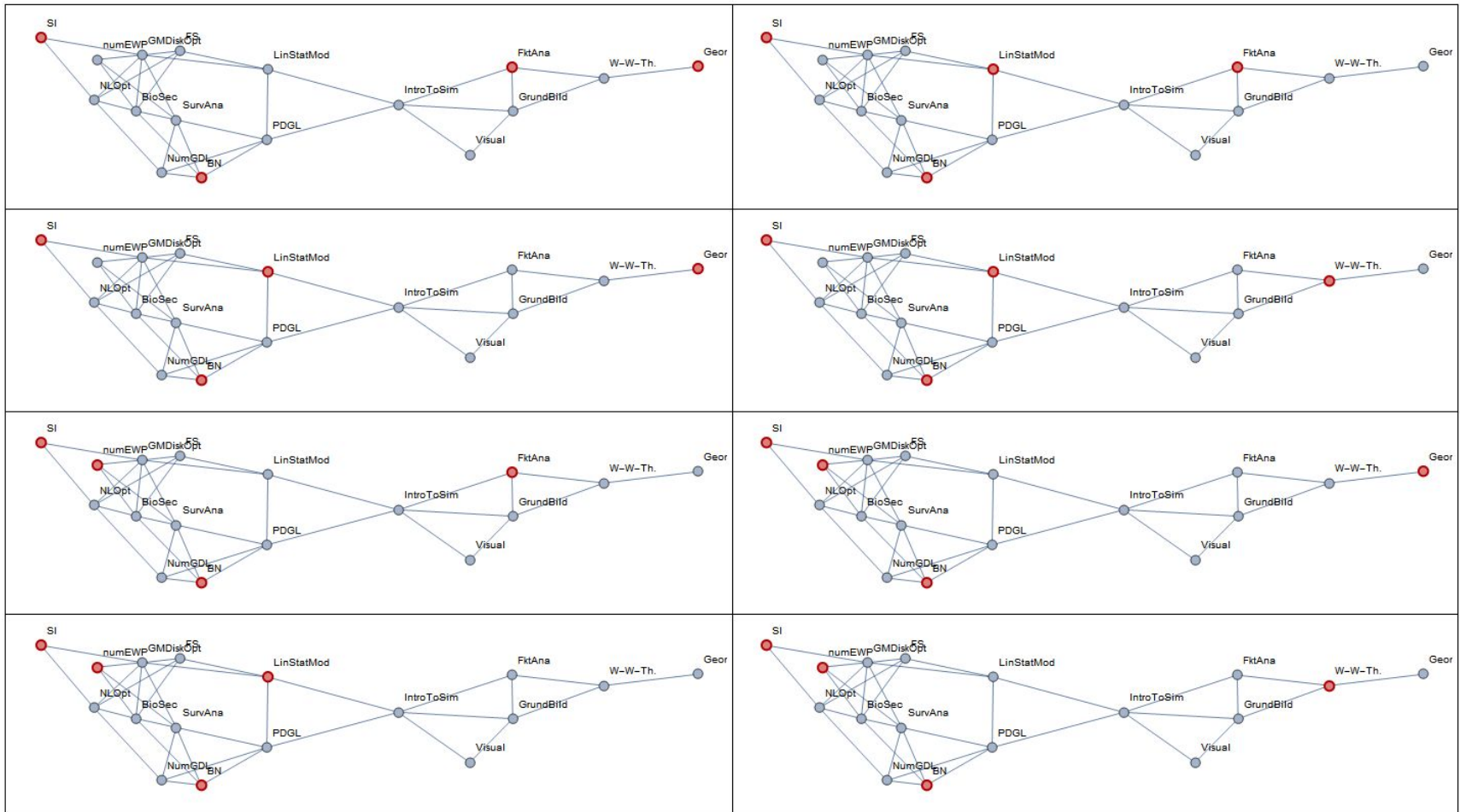
Solution: maximal independent set in *graph of all subjects*

V - subjects
E - same time



SUBJECTS SELECTION

Let's assume that you want subjects necessarily containing Bayesian Networks (BN) and Swarm Intelligence (SI). Then some possible combinations without timetable problems are:



POINT SYSTEM

Marks (best → worst): failed!

1.0, 1.3, 1.5, 1.7, 2.0, 2.7, 3.0, 3.3, 3.7, 4.0, **5.0**

*If mark $\neq$ 5.0 you receive **points***

Points (usually):

one class per week (SWS) costs **3 points**

one subject of

mathematics - **9 or 6 points**

comp. science - **6 points**

You need finally **30 points** to pass semester!

E.g.:

$$9+9+6+6 = 30$$

$$6+6+6+6+6 = 30$$

EXAMINATIONS

	Oral	Written	Presentation
<i>Subject:</i>	Mathematics	Computer Science	Team Projects
<i>Duration, min:</i>	30-45	120	20
<i>Language:</i>	German/English	English	English/German
<i>Features:</i>	• tête-à-tête • no preparation • no strict proofs • covering of all material	almost impossible to cheat	like our course/diploma thesis defence

OUR CHOSEN STUDIES

- Bayesian Networks
- Swarm Intelligence
- Survival Analysis
- Linear Statistical Models
- SwarmLab Team Project
- *German Language for Foreigners*

COMPUTER SCIENCE

Swarm intelligence

Prof. Sanaz Mostaghim



- English
- 1 lecture per week
- 1 exercise per week
- 6 final points

Bayesian Networks

Prof. Rudolf Kruse



- English
- 1 lecture per week
- 1 exercise per week
- 6 final points

MATHEMATICS

Survival Analysis

Prof. Waltraud Kahle



- German
- 2 lectures per week
- 4 exercises per semester
- 6 final points

Linear Statistical Models

Dr. Heiko Grossmann



- German
- 2 lectures per week
- 4 exercises per semester
- 6 final points

BAYESIAN NETWORKS

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$
A blue neon sign is mounted on a dark, textured ceiling. The sign displays the Bayesian formula $P(A|B) = \frac{P(B|A)P(A)}{P(B)}$ in a stylized, glowing blue font. The sign is rectangular and appears to be made of a dark material with the formula written on it in neon. The background is dark and textured, possibly a ceiling or wall.

BN: EXAMPLE

Available information:

“Malaria is much less likely than flu.”

“Flu causes cough and fever.”

“Nausea can indicate malaria as well as flu.”

“Nausea never indicated pneumonia before.”

Possible questions/inferences:

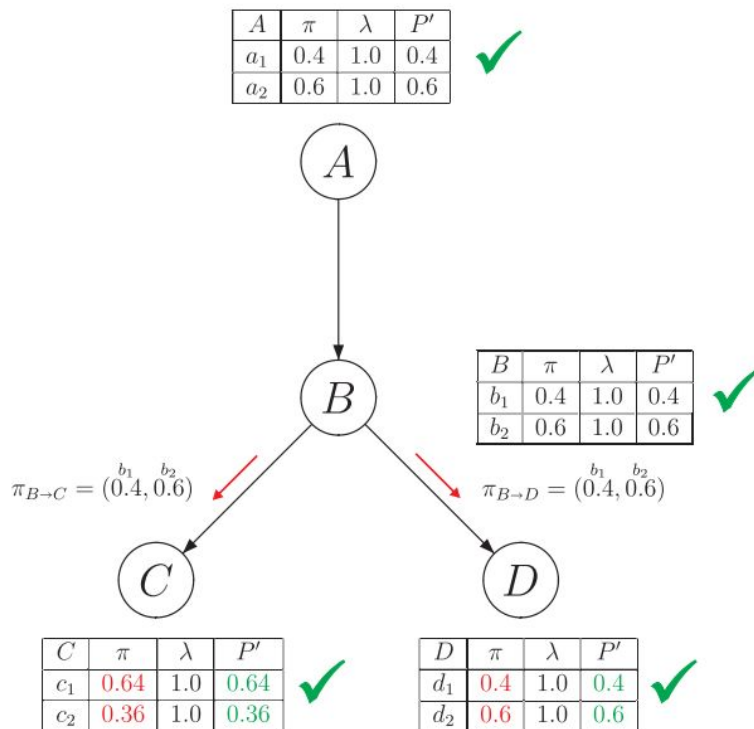
“The patient has fever. How likely is he to have malaria?”

“How much more likely does flu become if we can exclude malaria?”

BN: EXAMPLE

How does D depend on A?

- given apriori marginal probabilities
- using propagation via messages in network

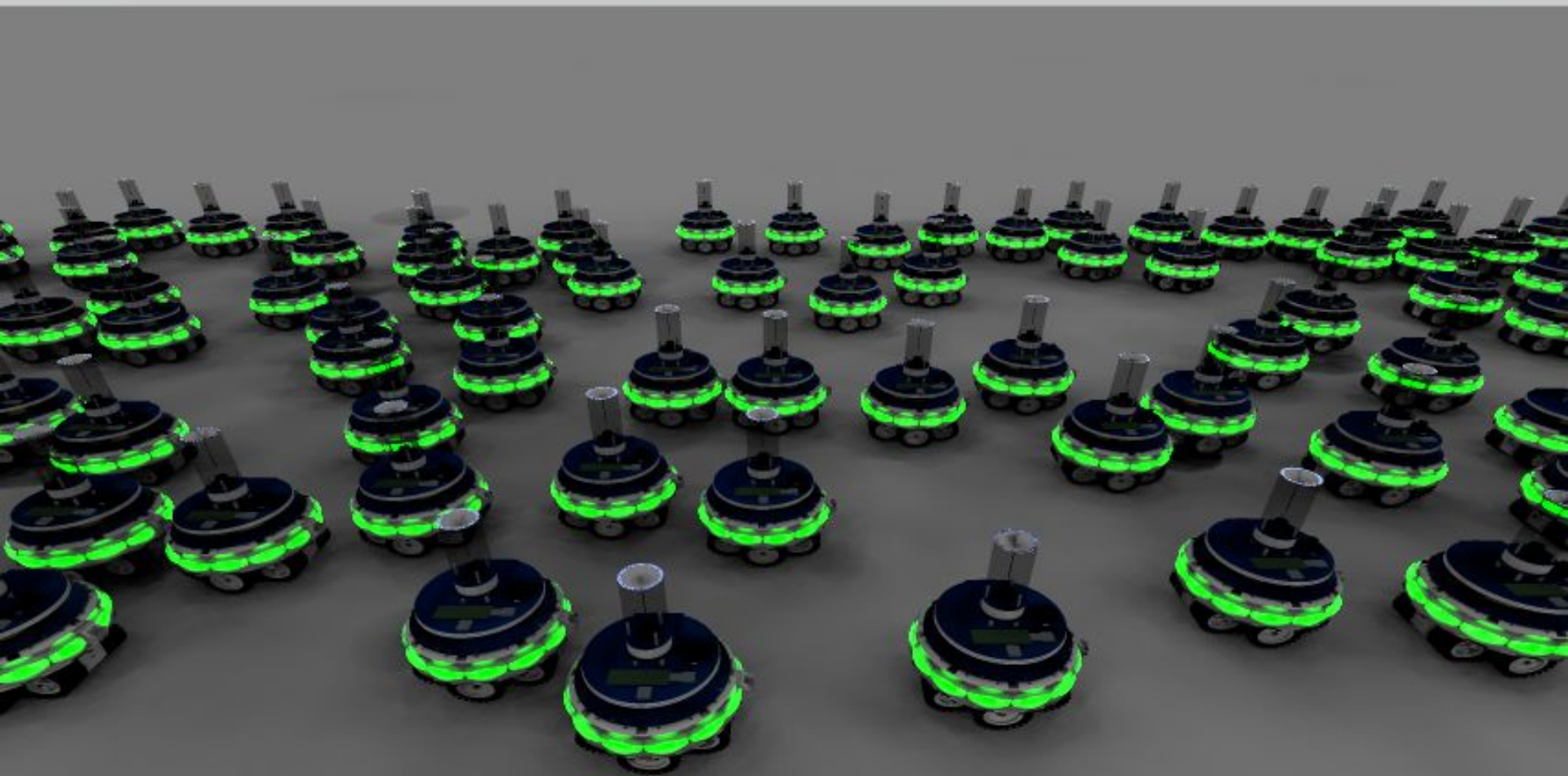


With 100 diseases and 200 symptoms, there would be about 10^{62} different scenarios for which we have to estimate the probability.

BAYESIAN NETWORKS

- interesting course with regular nontrivial exercises
- combination of probability and graph theory
- has many useful applications (rarely in Belarus)
- connected with machine learning and data science
- only course with required homework
- students were much educated than those at other courses
- we've spent the *most* time and got the *worst* marks

SWARM INTELLIGENCE



SWARM INTELLIGENCE

A collective behavior of simple entities having simple rules with ability of local interactions. The swarm produces a global and intelligent behavior which is unknown to the single entities: “The whole is more than the sum of its parts!”

This global behavior is known as *emergence* or *emergent effect*.

Emergent effects may be desired or undesired

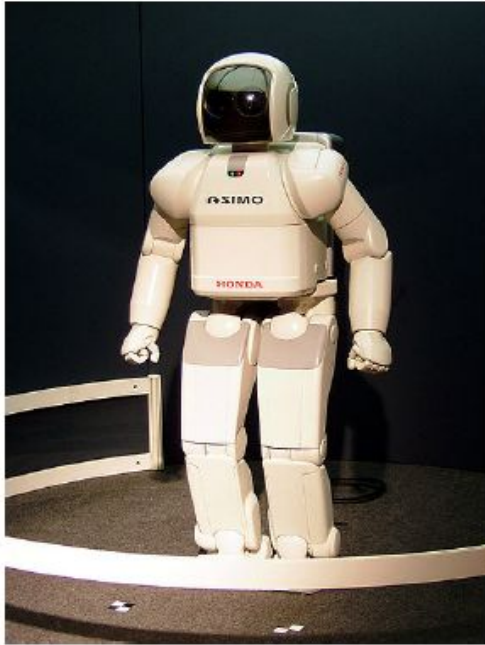
- How can we generate positive emergence?
- How can we prevent negative emergence?

Examples:

- Ant roads
- Economy
- „Green wave“ by traffic lights
- Traffic jam on the highway
- Internet

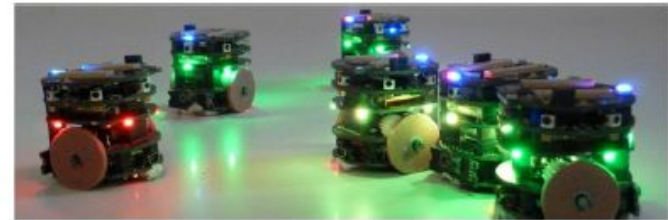


Example: Swarm Robotics



- Cost
- Robust against failures
- Flexible
- Scalable
- Easy to re-program for new tasks

Note: These can substitute one agent for only some specific tasks.



New challenges:

- Small hardware
- Communications
- Self-organization
- Coordination mechanisms
- Collaborative learning

SWARM INTELLIGENCE

- unusual and interesting course with many applications
- has intersection with Malevich's course NN&GA
- you need no background
- charismatic lecturer with perfect English
- we've spent the *least* time and got the *best* marks

SURVIVAL ANALYSIS

Your Expected Lifetime left : **31 YEARS***

** Expectation can have an error of +/- 30 years*



SA: EXAMPLE

Given: sample of refrigerators

Task: set guarantee period such that at least 95% of refrigerators will work after that

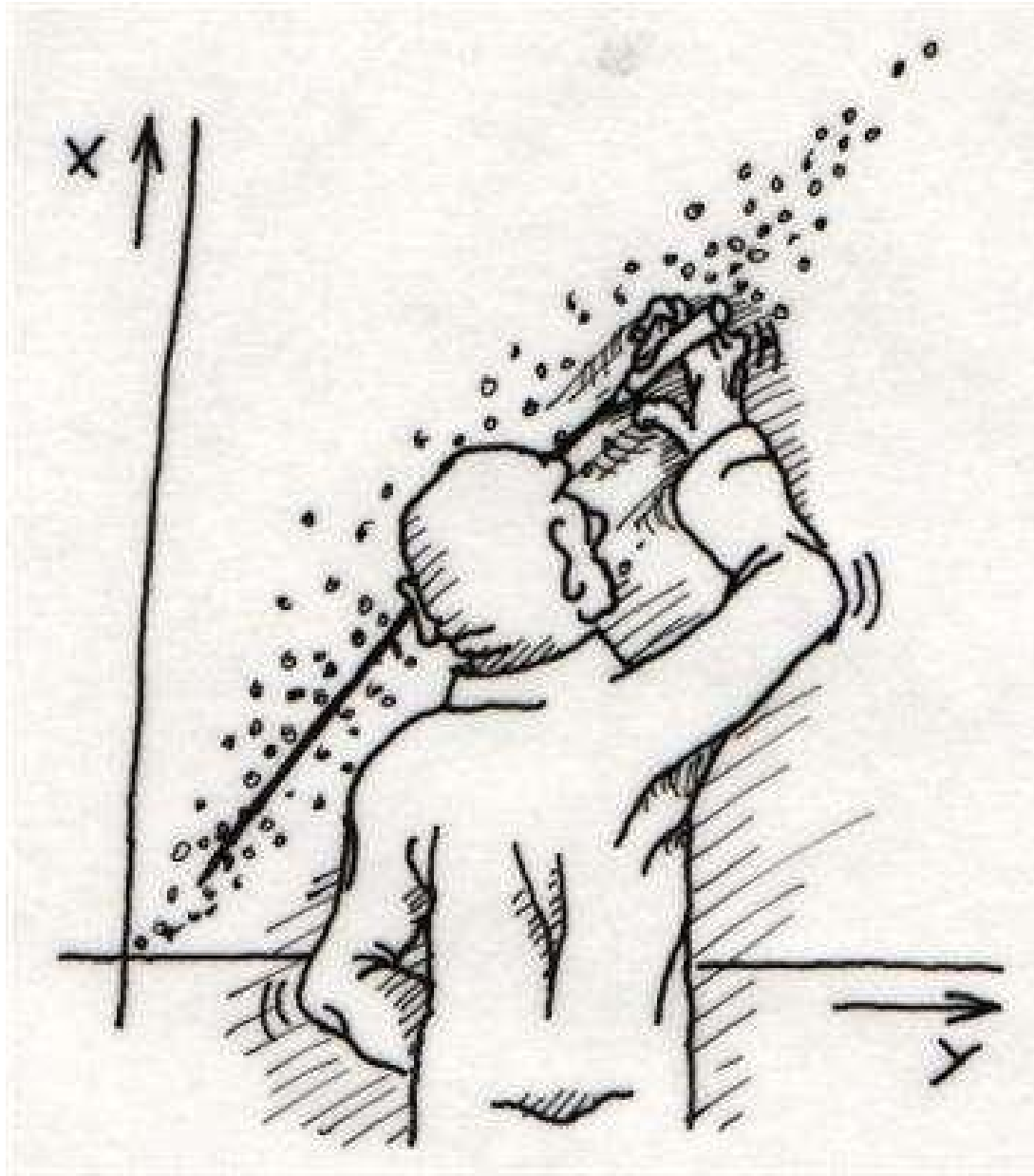
Problem: we don't have time to wait till sample breaks without impact

Solution: different methods of survival analysis (e.g. stress-testing, Cox-model)

SURVIVAL ANALYSIS

- there're not so many such courses and covered material
- direct applications in medicine, social science, insurance
- it needs basic but *strong* statistical background
- there will be intro in R and its survival package
- bonus: professor speaks Russian

LINEAR STATISTICAL MODELS



LSM: EXAMPLE

Given: two groups of patients, one receive new drugs.

Task: figure out the effectiveness of drugs.

Problem: in some situations we cannot dispose of other differences between groups

Solution: analysis of variance (ANOVA)

LINEAR STATISTICAL MODELS

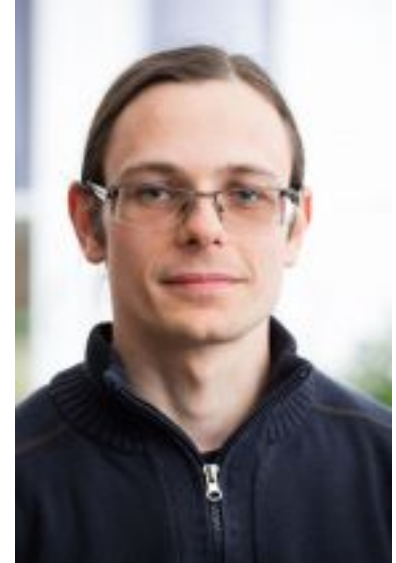
- real oldschool mathematical subject
- combination of statistics, algebra and geometry
- a strict mathematical exposition of statistical models
- common methods in rather different linear models
- a large set of materials in English/German/Russian
- applications in machine learning and data analysis

TEAM PROJECT IN SwarmLab

Pr. Sanaz Mostaghim



Christoph Steup



remote control
robotics flight quadcopters swarm
wall-avoidance
copters
artificial intelligence drones
robust
sonars
optimization

Topic: *Robust Multi-Copter Flight*

1 official meeting per week

much more hours of real work per week

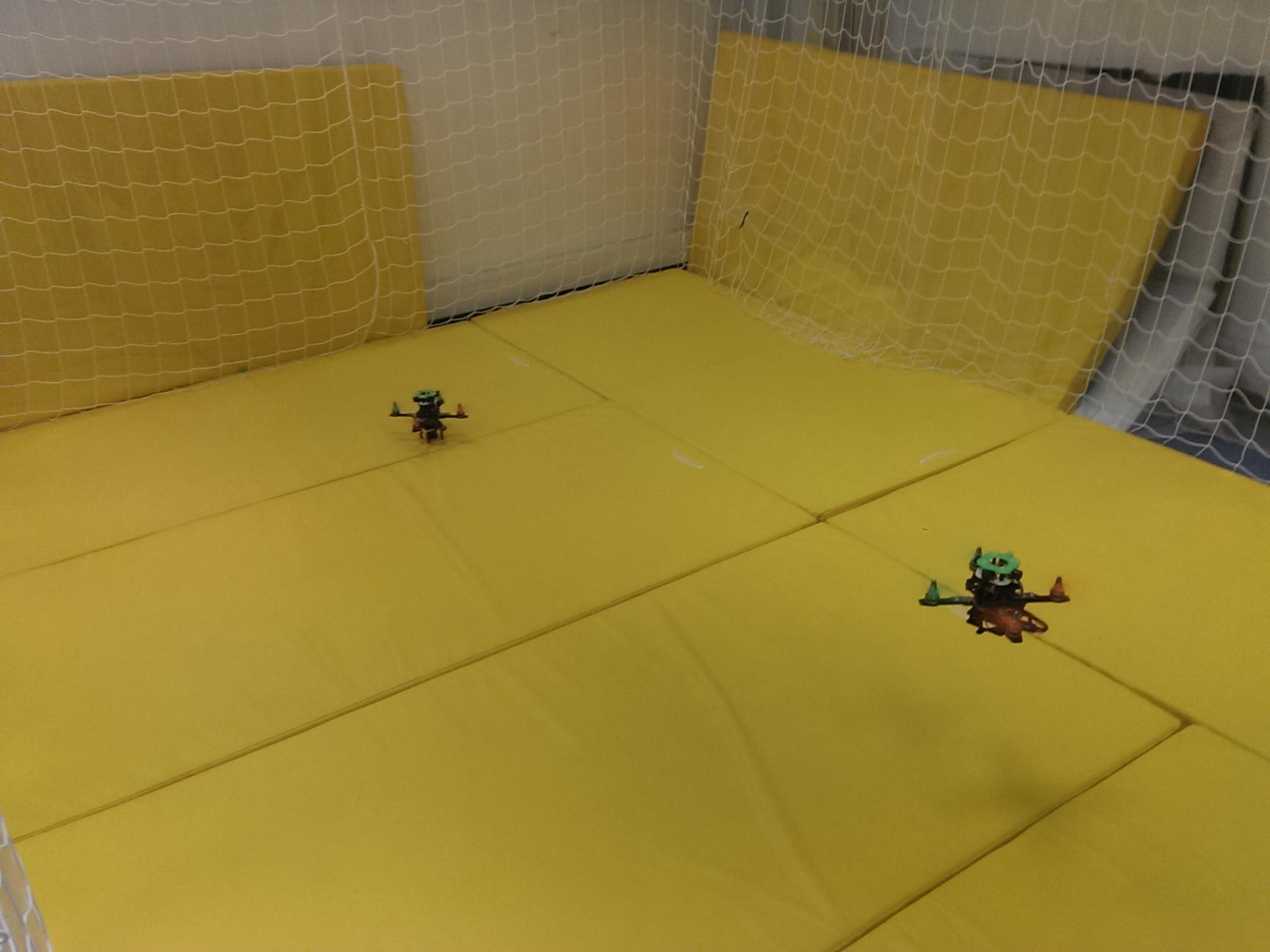
6 final points

Copters: EXPECTATION



Copters: REALITY





ROBUST MULTI-COPTER FLIGHT

- real team-project with time & code organization in GitHub
- better understanding of copter's physic and “hardware”
- typical data analysis: do data and give result
- team of SwarmLab are super-educated geeks
- sometimes it was very funny

Motivation:

Flights are not always robust



LEISURE TIME

- diploma thesis writing [**sarcasm**]
- basketball / football - *several sport grounds are around*
- bicycles - *main type of transport*
- shopping - *sales-sales-sales*
- self-education - *deeper in studies, online-courses*
- TRAVELLING!!! - *especially cheap*

TRAVELLING



*We visited not so much
as in summer trip, but...*

Krakow
Vilnius
Brussels
Ostende
Leipzig
Vienna
Bruges
Amsterdam
Wittenberg
Thale
Quedlinburg
Ghent
Hamburg
Erfurt
Berlin
Cologne
Hannover
Katowice
Warsaw
Dresden



EXPECTED DISADVANTAGES

- you will lose last semester of normal BSU studies
- you can't spend this time to find a job
- after coming back you will have terrible March (... and April, and, probably, May)
- you will start counting floors starting with 0

Now it's time for you to ask questions!

