Digital Social Science Lab – Copenhagen University

Opening Reception, 18th Feb 2015

From Counting to Connecting

Network Visualisations and Complex Social Systems

Net-Sights

Network Insights for Collaborative Sustainable Production

Danmarks Tekniske Universitet

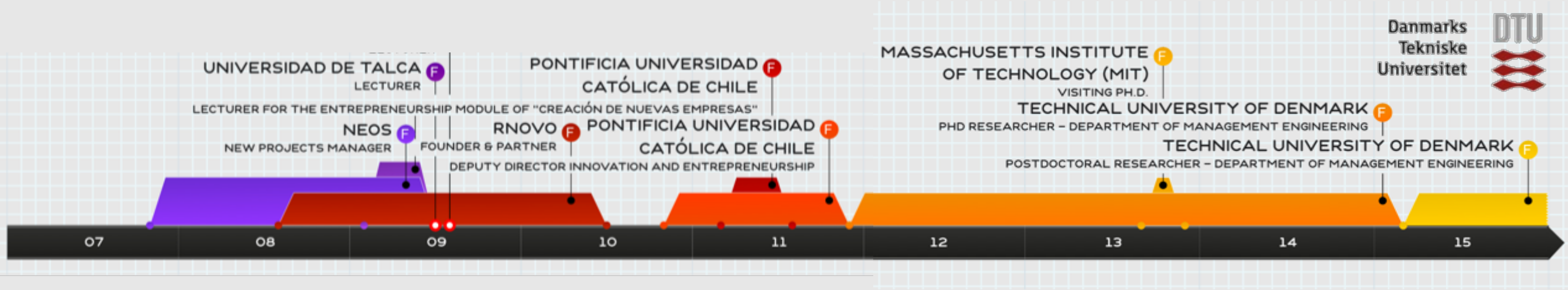
DTU

About me

Pedro Parraguez
Postdoc – DTU Management Engineering

PhD Thesis

A Networked Perspective on the Engineering Design Process:
At the Intersection of Process and Organisation Architectures



Net-Sights

DTU Management Engineering
Institut for Systemer, Produktion og Ledelse

The Engineering Systems Division

http://es.man.dtu.dk

Socio-technical data-driven approach to understand and support complex engineering systems

Division leader:
Prof Anja M. Maier

From Counting to Connecting

Network Visualisations and Complex Social Systems

Case 1

Danish Cleantech Industry

Case 2

DTU´s Knowledge Landscape

Wrap up

Introduction

Network Visualisations and Complex Social Systems

WE ARE BEING
CONTROLLED
BY THE RANDOM
OUTCOMES OF A
COMPLEX SYSTEM
Samuel

From Counting

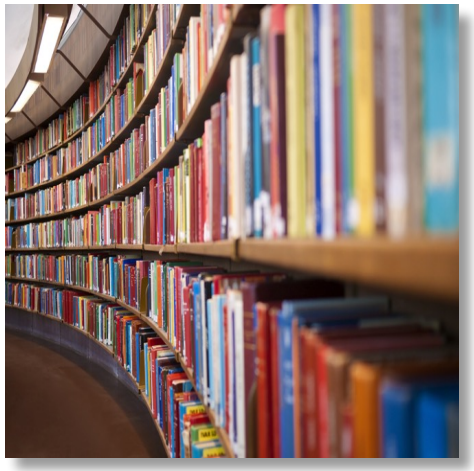
to Connecting

From counting to connecting
[building blocks]

Data-driven

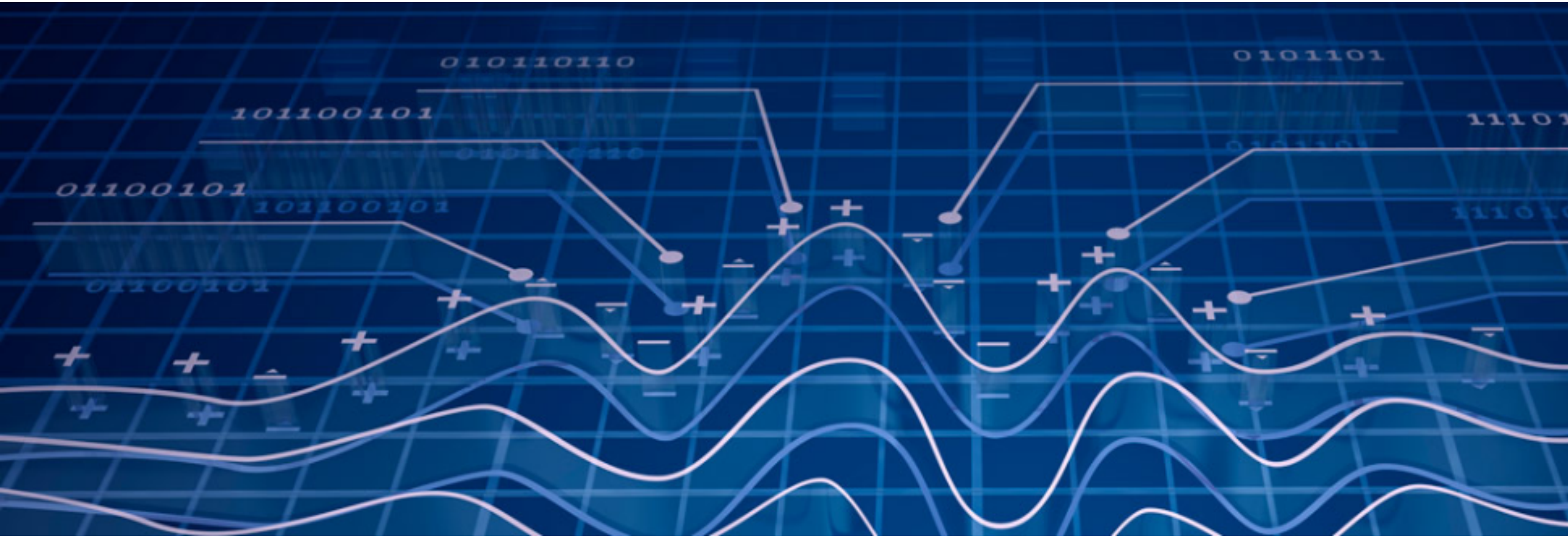
System thinking

Exploration



Understanding

From top-down expert opinions to data-driven insights



From Units to System(s)

From Search to Discovery

From KPI's to Key Performance Predictors

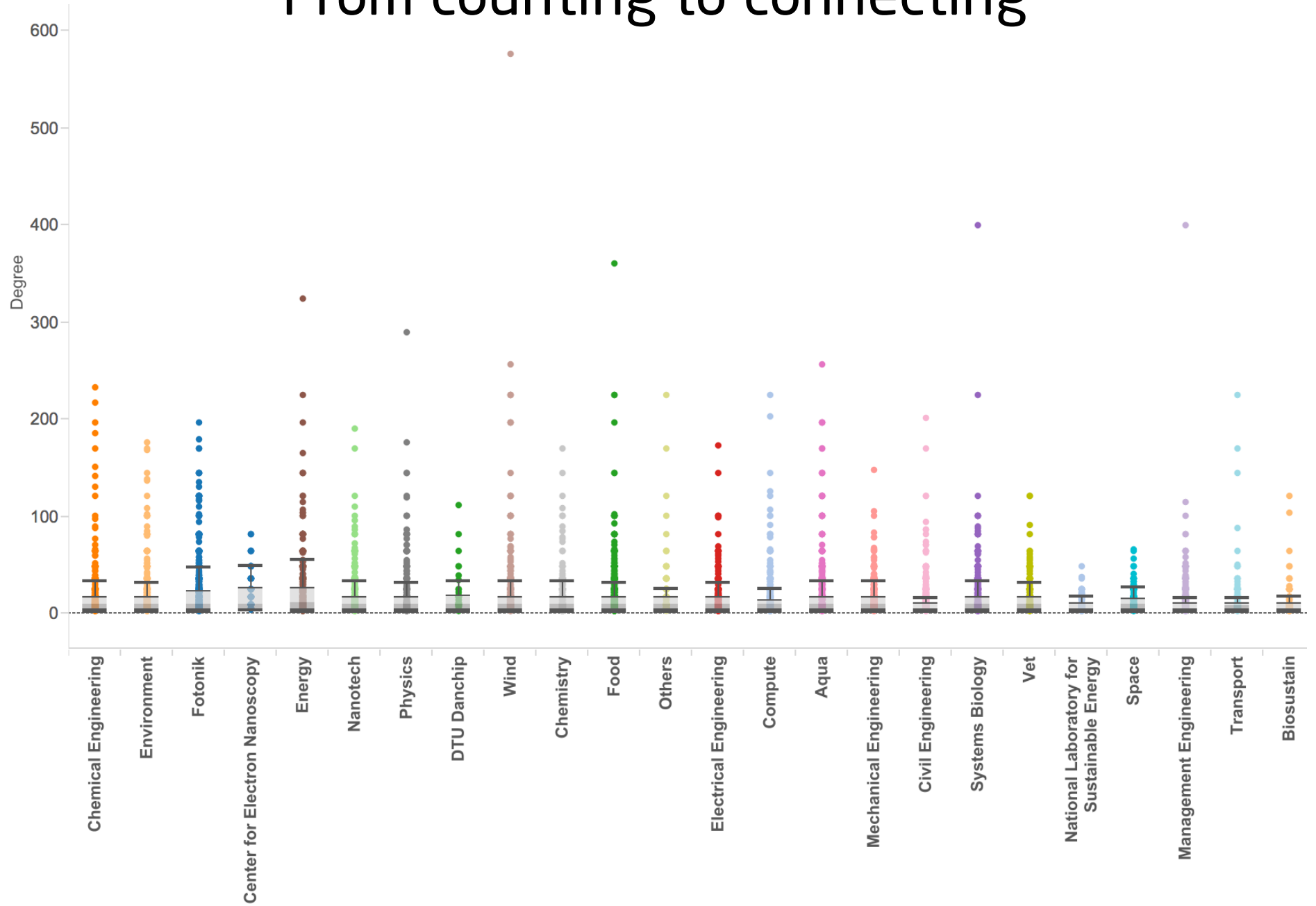
From counting to connecting

Publication types - 2015 - DTU Orbit (13/02/2016)

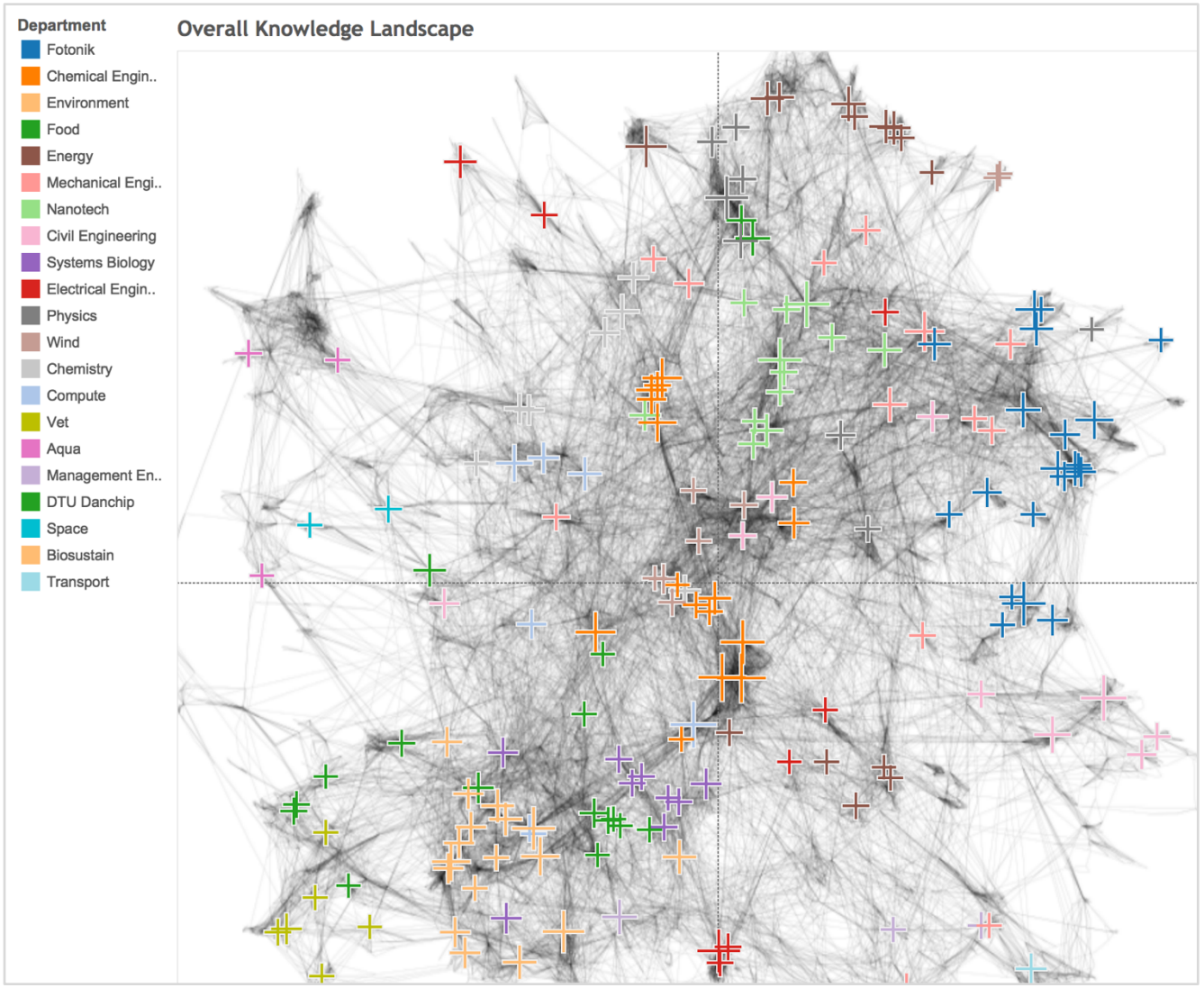
1. Publication types (DTU records)

		Count
No. 1	Contribution to Journal	3718
No. 2	Book/anthology/thesis/report	751
No. 3	Contribution to book/anthology/report	1838
No. 4	Contribution to conference	857
No. 5	Working paper	4
No. 6	Contribution to newspaper	46
No. 7	Memorandum/exposition	8
No. 8	Contribution to memorandum/exposition	2
No. 9	Net publication	73
No. 10	Patent	61
No. 11	Non-text contribution	206
No. 12	Other	1

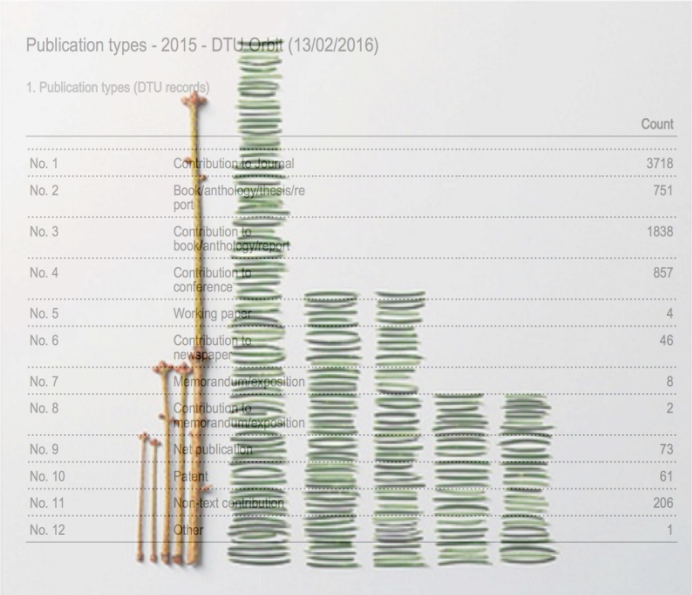
From counting to connecting

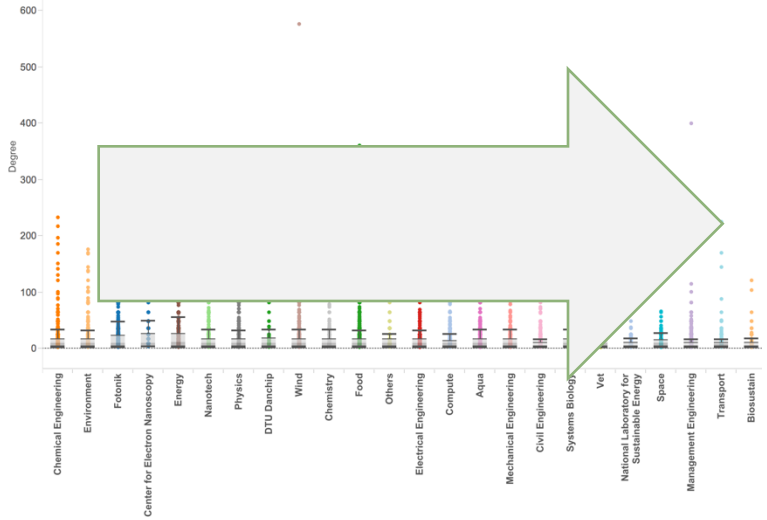


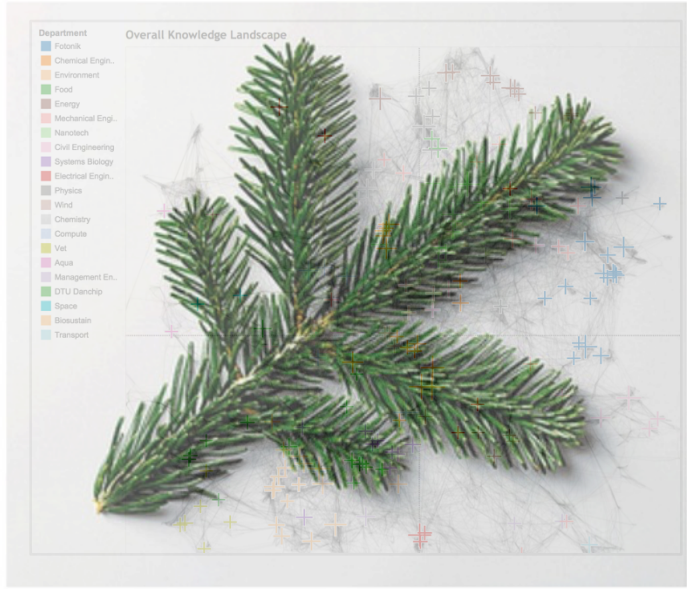
From counting to connecting



From counting to connecting
[From tables to networks]







Case 1

Net-Sights: Network Insights for Collaborative Sustainable Production

Net-Sights

Network Insights for Collaborative Sustainable Production

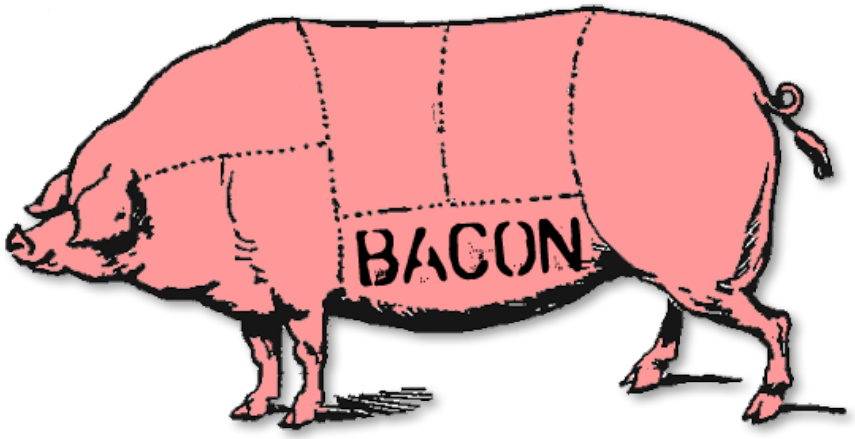
Finding the right partner

The urgent need for sustainability

www.netsights.dk

Net-Sights

Learning from the past



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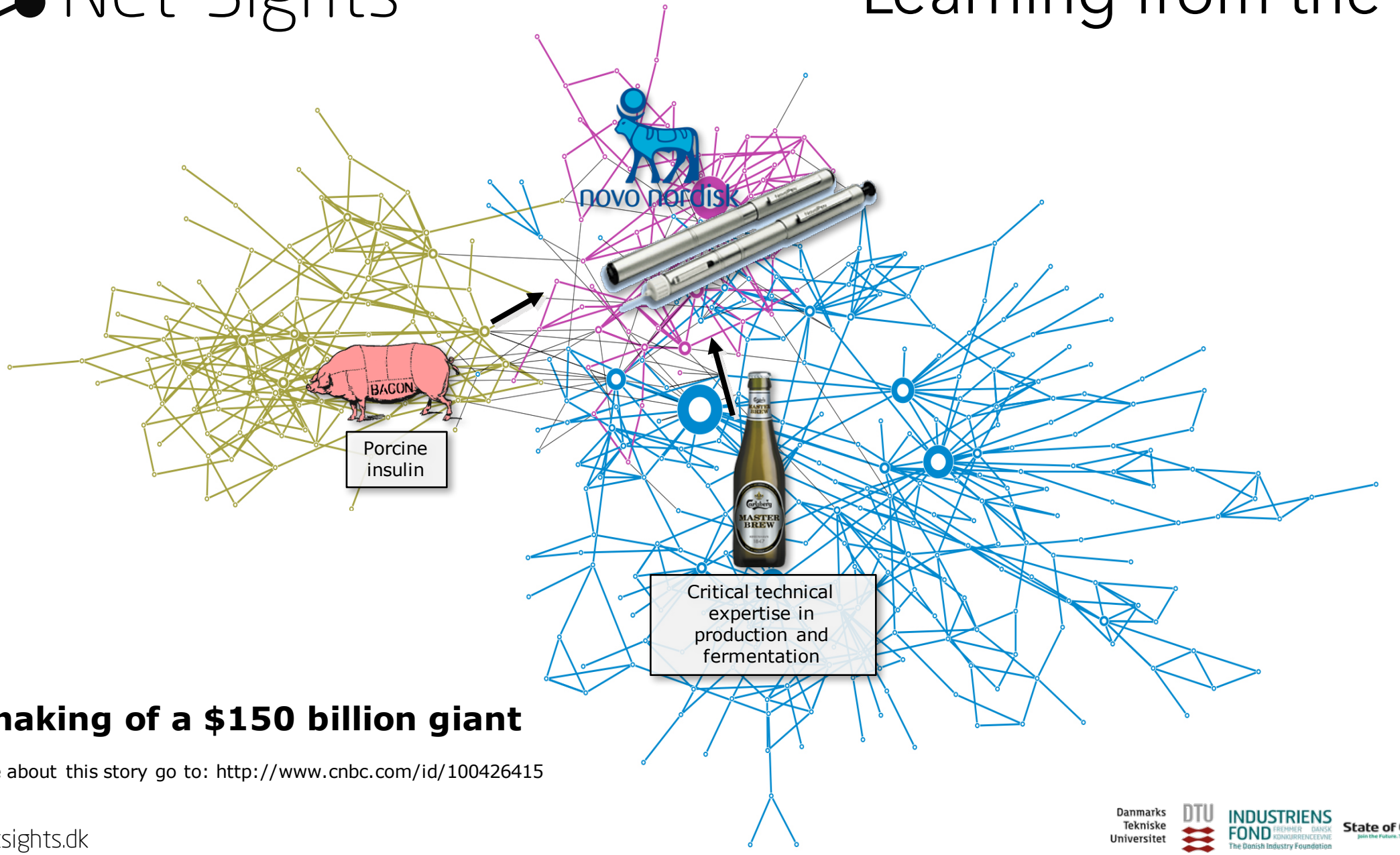
Net-Sights

Learning from the past



The making of a $150 billion giant

For more about this story go to: http://www.cnbc.com/id/100426415

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Net-Sights

Challenge: Proactively identify collaboration partners to develop and deploy innovative and sustainable solutions to market.

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Net-Sights

Four factors for successful collaborations

Technological closeness

Relational closeness

Geographical closeness

Organisational variables

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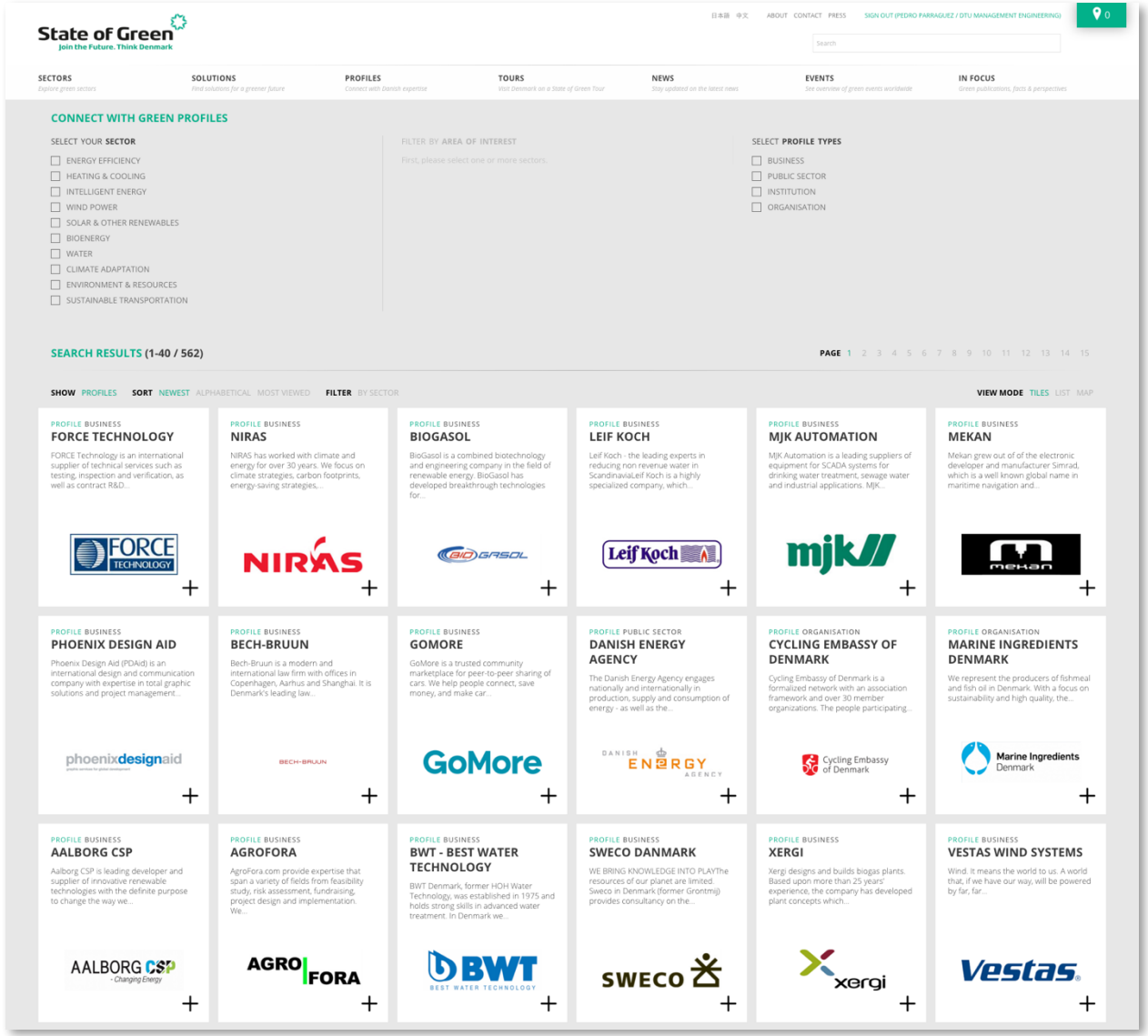
Net-Sights

Turning rich data
into network insights



www.netsights.dk

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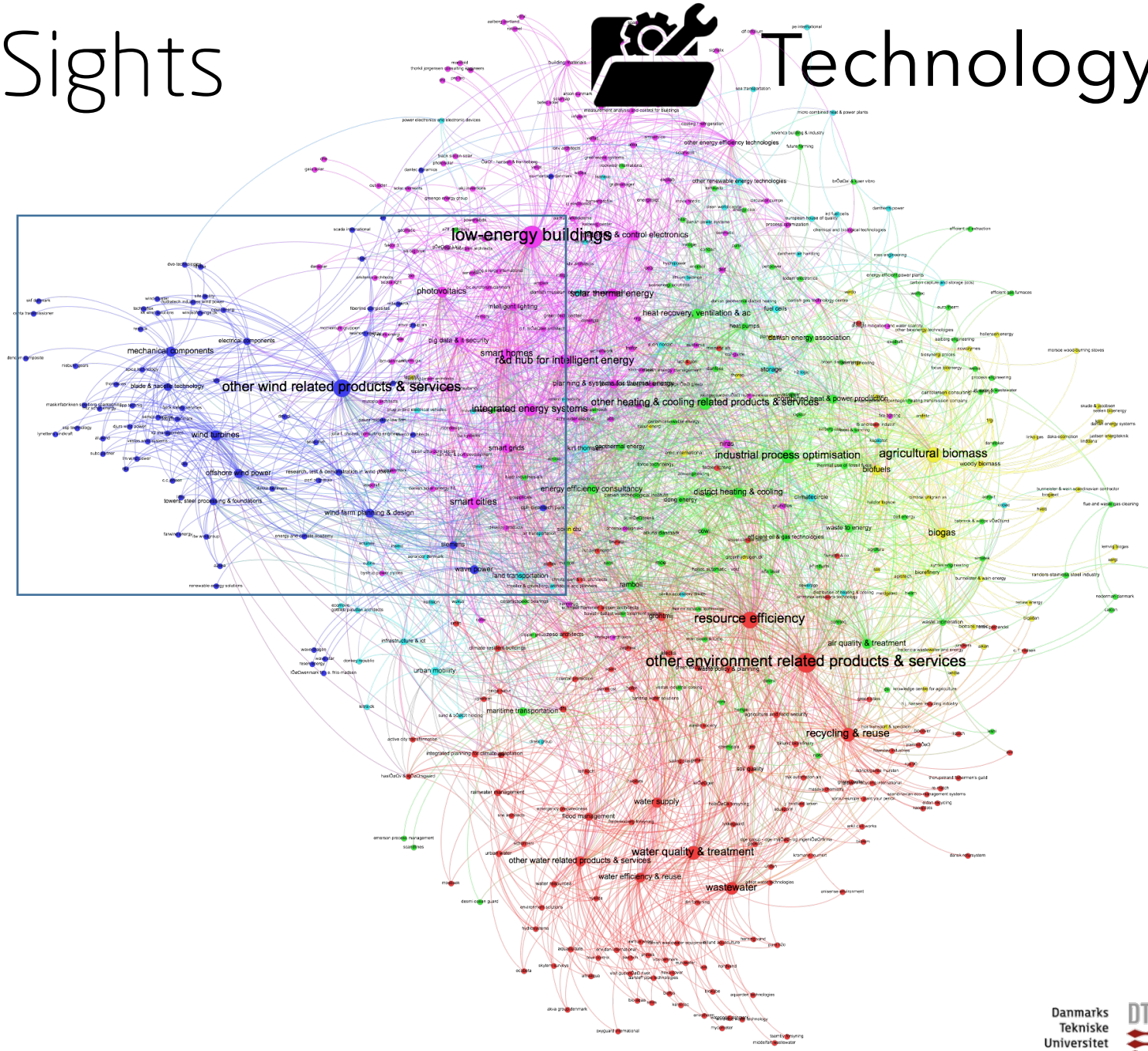
clean

Net-Sights

Technology landscape



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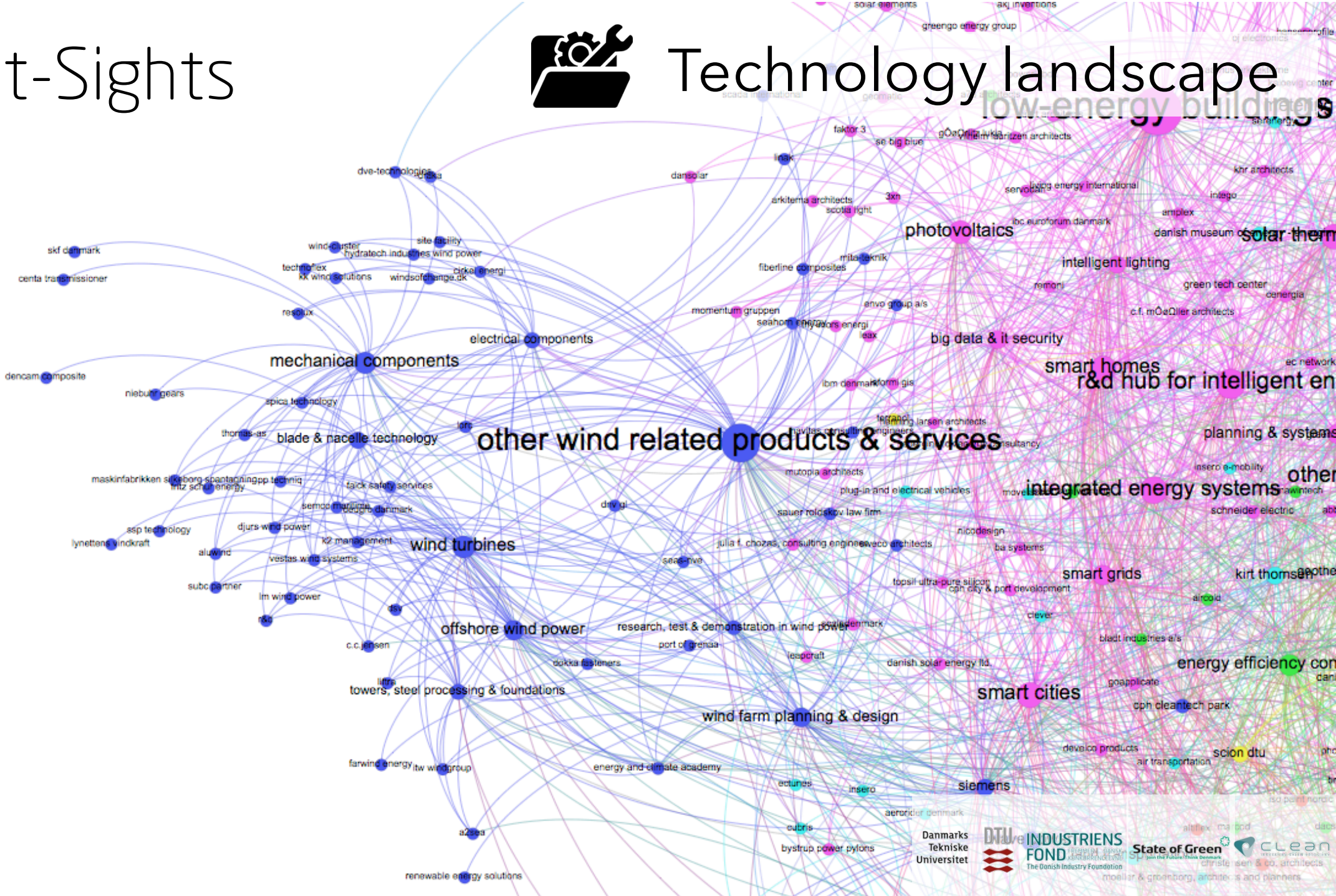
Net-Sights

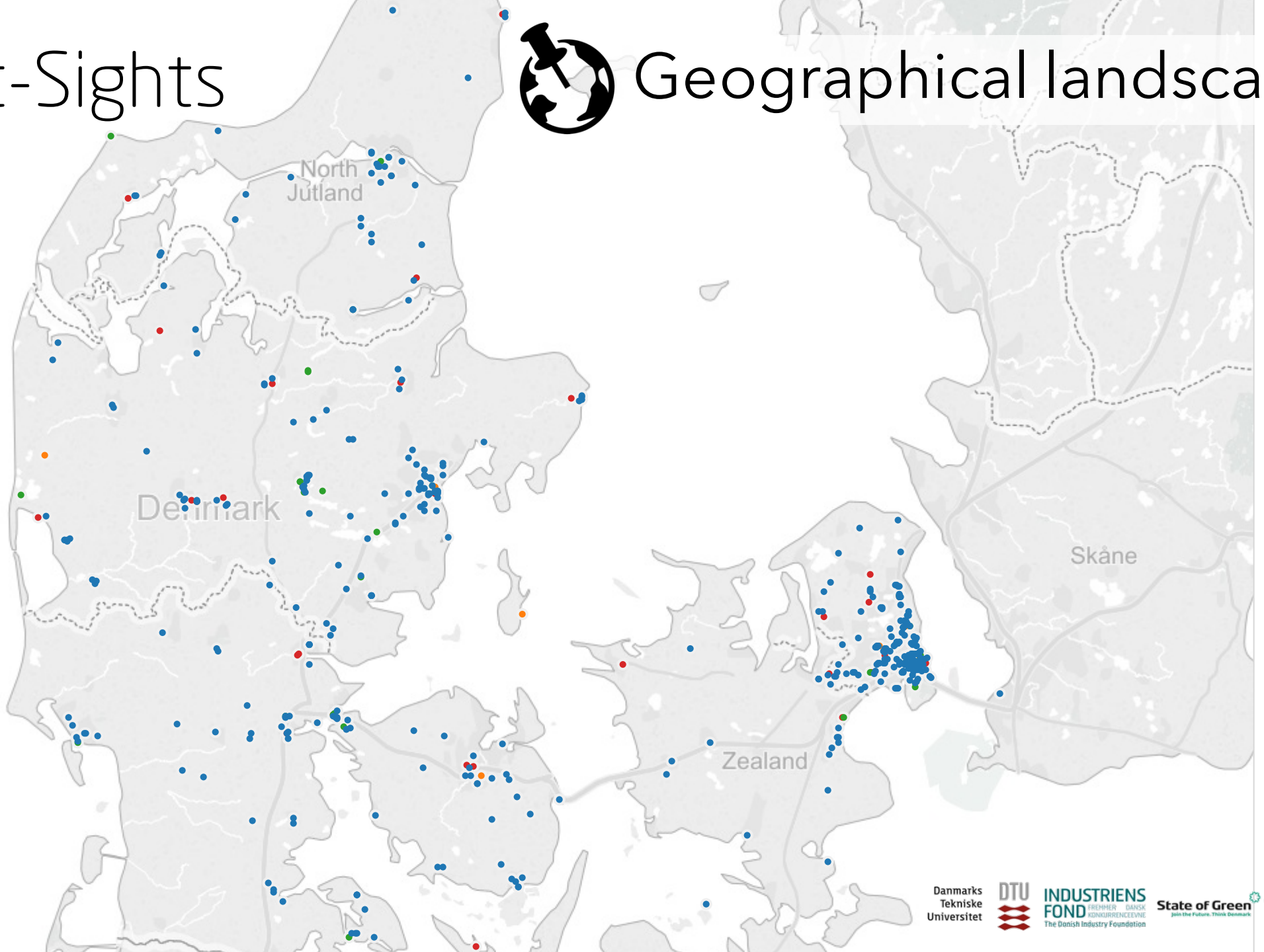
Technology landscape



www.netsights.dk

Net-Sights

Geographical landscape



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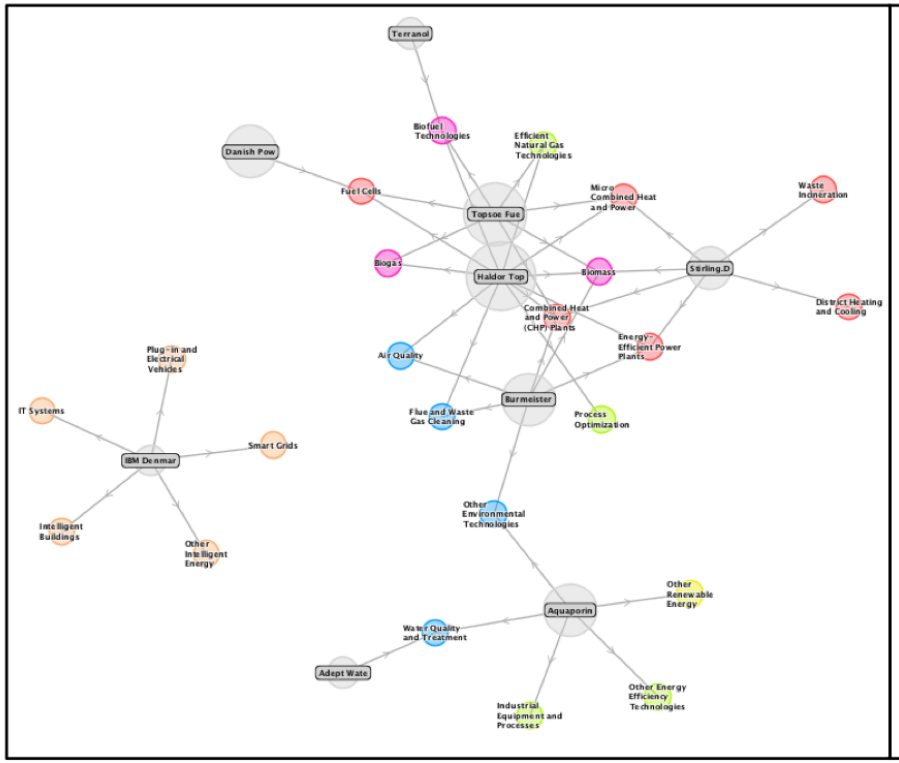
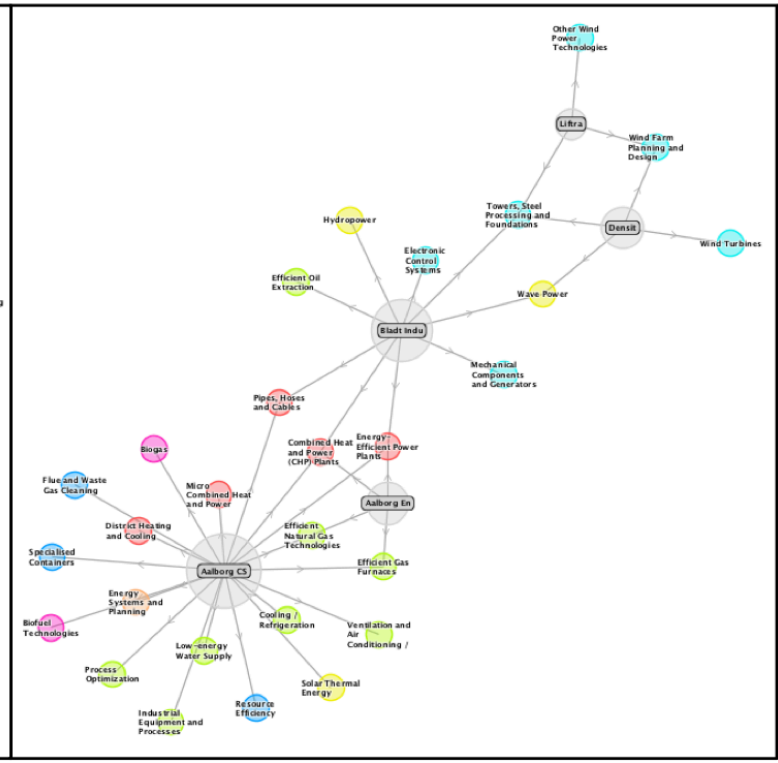
Net-Sights

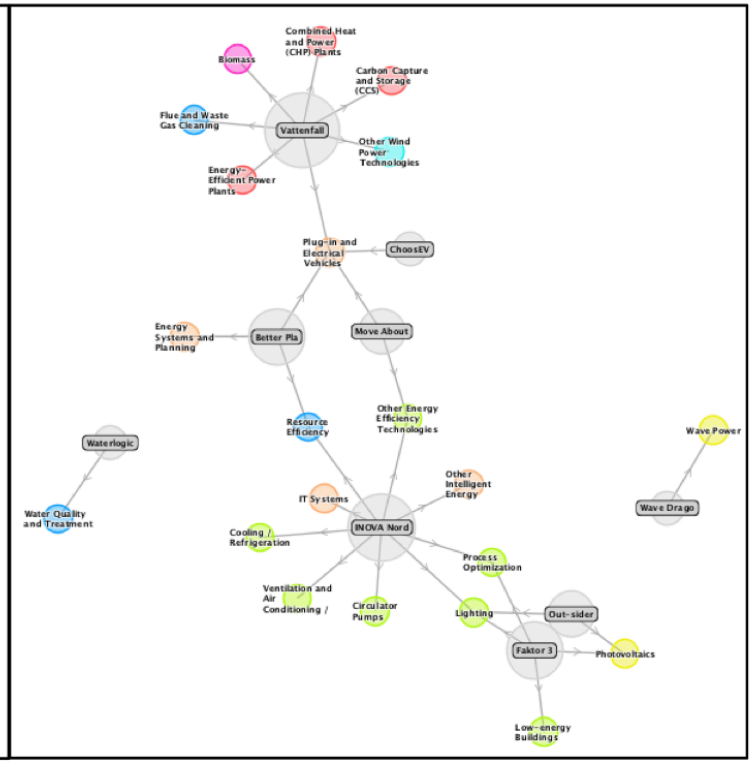
Geographical landscape



Lyngby



Aalborg



Copenhagen

Parraguez, P. & Maier, A.M., 2012. Mapping industrial networks as an approach to identify inter-organisational collaborative potential in new product development. In Encuentros Paris 2012 - Knowledge for Economic and Social Development.

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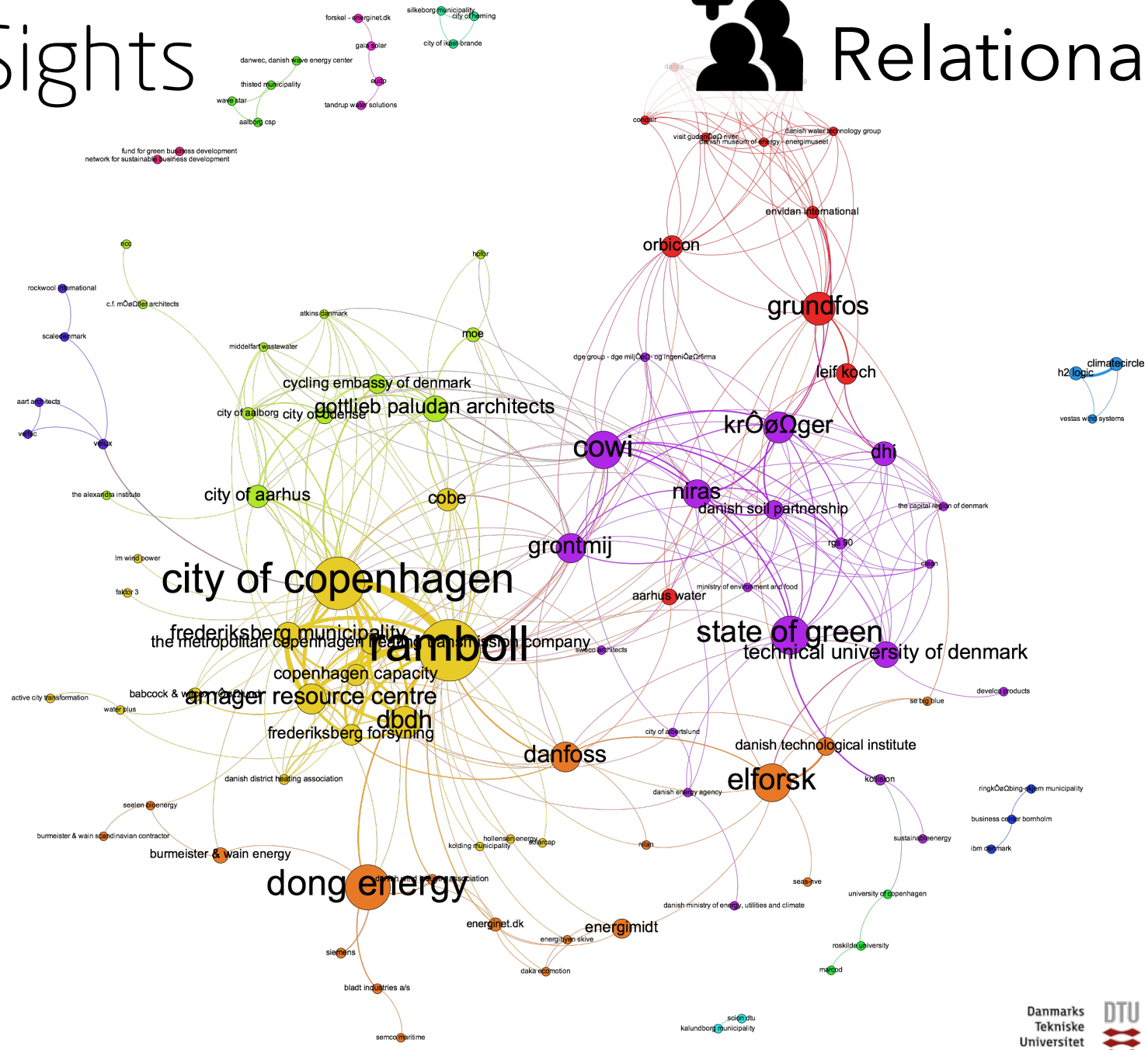
Net-Sights

Relational landscape



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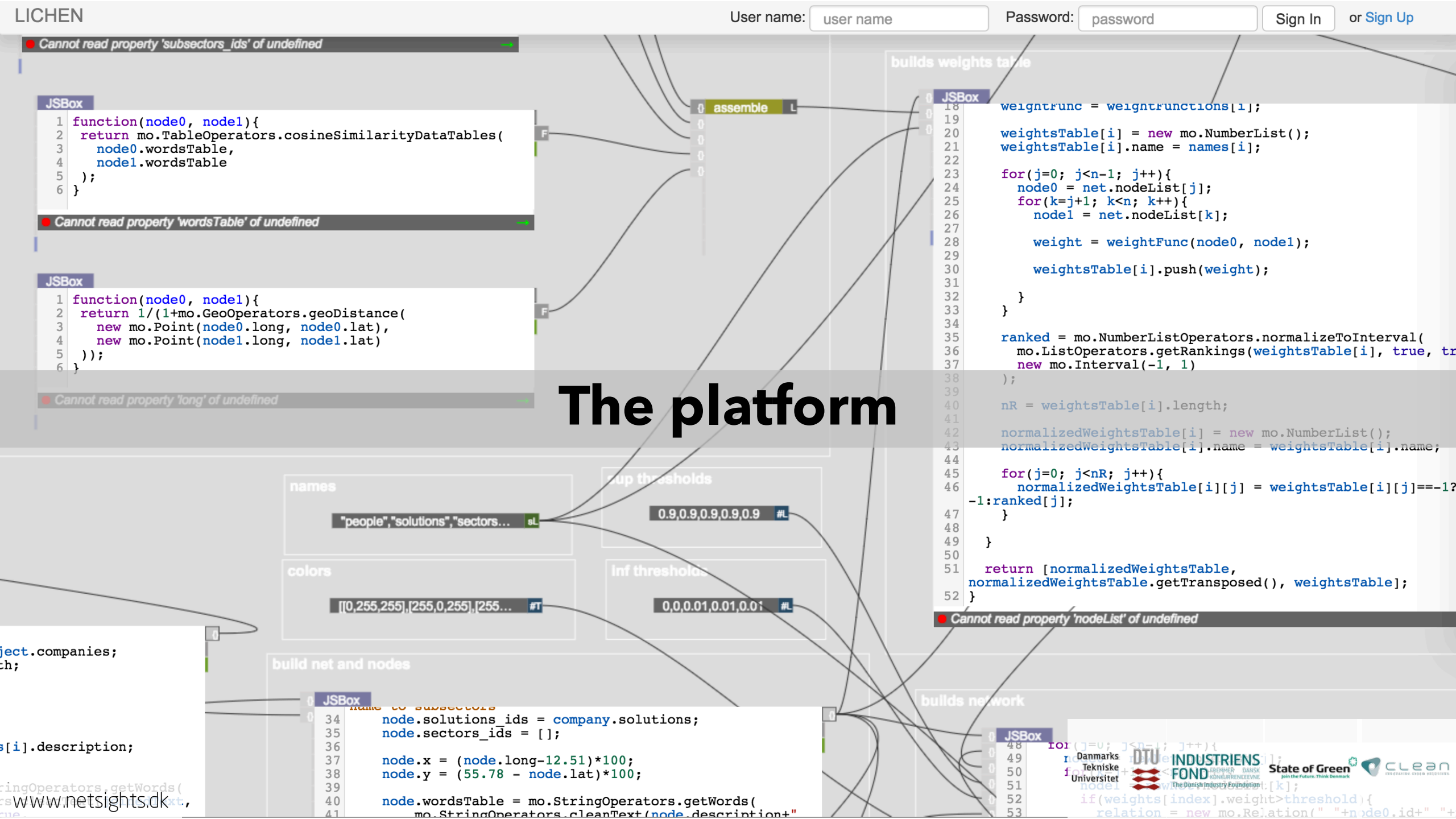
State of Green Join the Future. Think Denmark

CLEAN


LICHEN
User name: user name
Password: password
Sign In
or Sign Up
Cannot read property 'subsectors_ids' of undefined
JSBox
function(node0, node1){
return mo.TableOperators.cosineSimilarityDataTables(
node0.wordsTable,
node1.wordsTable
);
}
Cannot read property 'wordsTable' of undefined
JSBox
function(node0, node1){
return 1/(1+mo.GeoOperators.geoDistance(
new mo.Point(node0.long, node0.lat),
new mo.Point(node1.long, node1.lat)
));
}
Cannot read property 'long' of undefined
assemble
builds weights table
JSBox
weightFunc = weightFunctions[i];
weightsTable[i] = new mo.NumberList();
weightsTable[i].name = names[i];
for(j=0; j<n-1; j++){
node0 = net.nodeList[j];
for(k=j+1; k<n; k++){
node1 = net.nodeList[k];
weight = weightFunc(node0, node1);
weightsTable[i].push(weight);
}
}
ranked = mo.NumberListOperators.normalizeToInterval(
mo.ListOperators.getRankings(weightsTable[i], true, tr
new mo.Interval(-1, 1)
);
nR = weightsTable[i].length;
normalizedWeightsTable[i] = new mo.NumberList();
normalizedWeightsTable[i].name = weightsTable[i].name;
for(j=0; j<nR; j++){
normalizedWeightsTable[i][j] = weightsTable[i][j]==-1?
-1:ranked[j];
}
}
return [normalizedWeightsTable,
normalizedWeightsTable.getTransposed(), weightsTable];
}
Cannot read property 'nodeList' of undefined
The platform
names
"people","solutions","sectors...
sL
up thresholds
0.9,0.9,0.9,0.9,0.9
#L
colors
[[0,255,255],[255,0,255],[255...
#T
Inf threshold
0,0,0.01,0.01,0.0
#L
build net and nodes
JSBox
node.solutions_ids = company.solutions;
node.sectors_ids = [];
node.x = (node.long-12.51)*100;
node.y = (55.78 - node.lat)*100;
node.wordsTable = mo.StringOperators.getWords(
builds network
JSBox
ject.companies;
th;
s[i].description;
www.netsights.dk
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DTU
INDUSTRIENS FOND
The Danish Industry Foundation
State of Green
clean

Case 2

DTU´s Knowledge Landscape

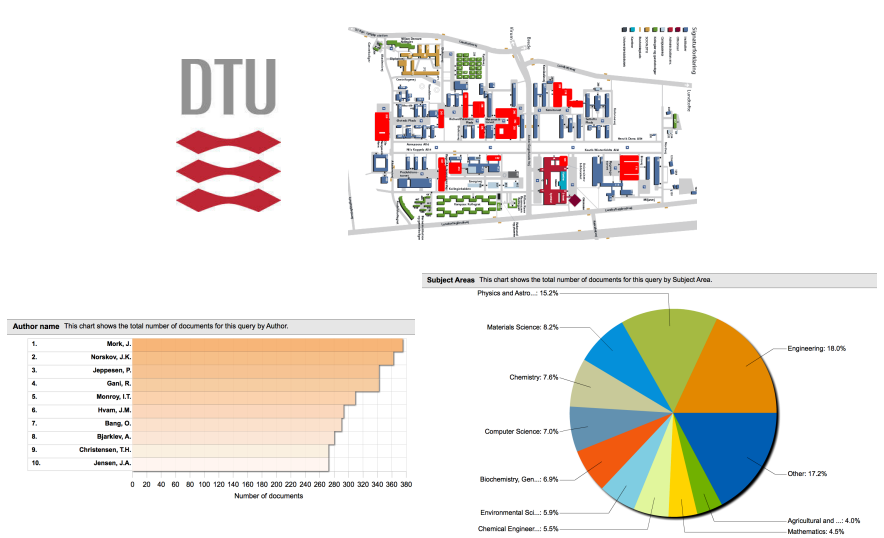
A socio-technical process of information transformation

Danmarks Tekniske Universitet

DTU

Engineering system: 'A class of systems characterized by a high degree of technical complexity, social intricacy, and elaborate processes, aimed at fulfilling important functions in society' (de Weck et al., 2011, p. 31).

From counting to connecting

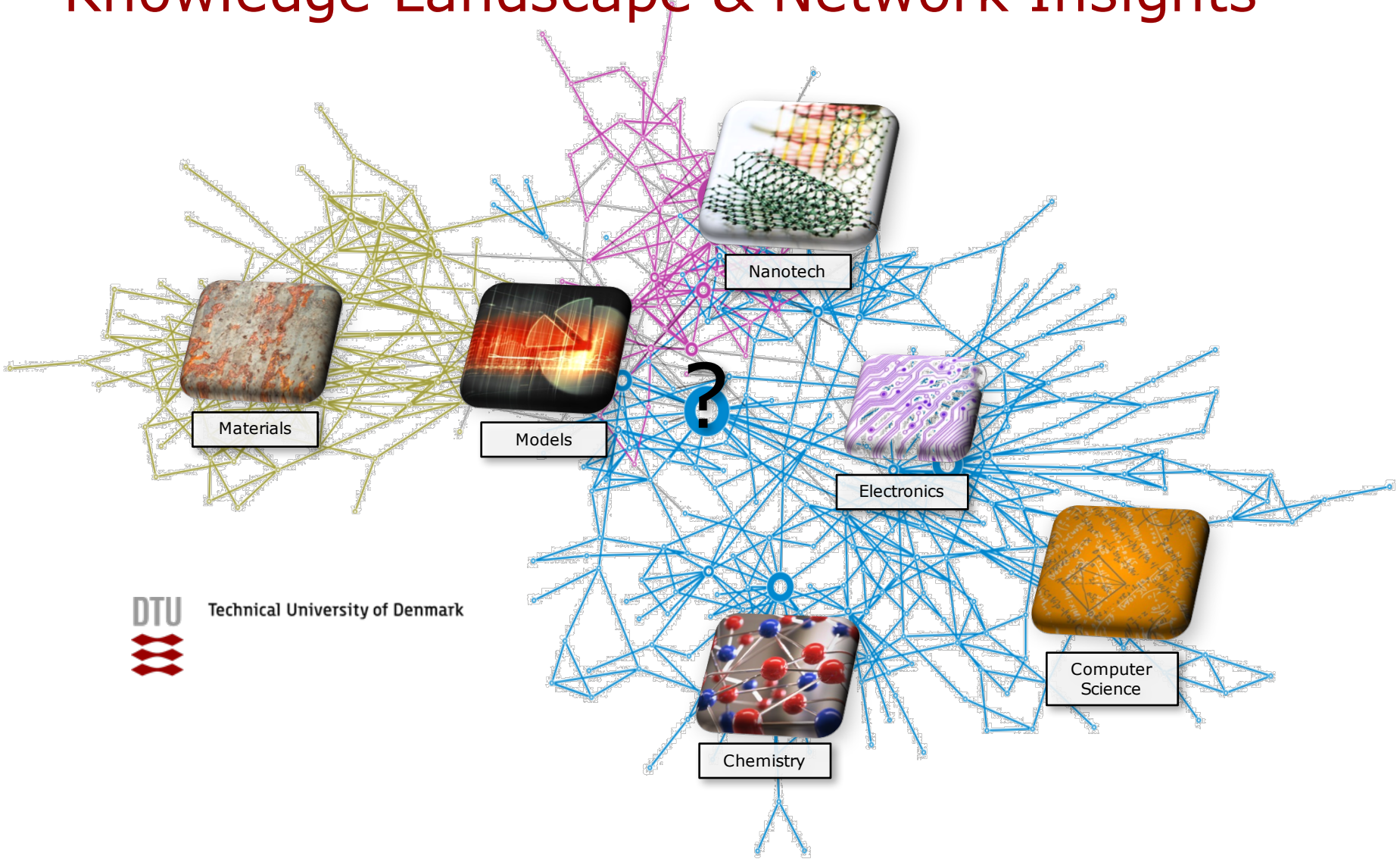


Knowledge census

Knowledge landscape

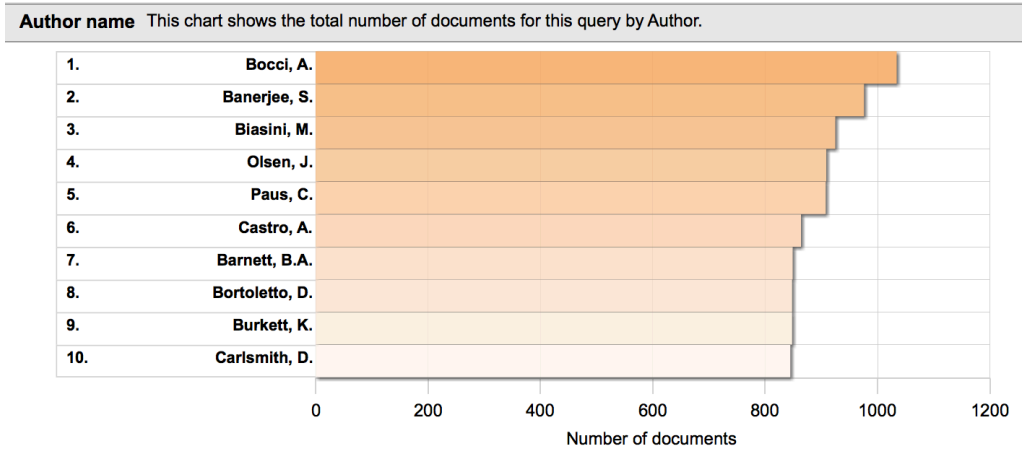
From counting to connecting

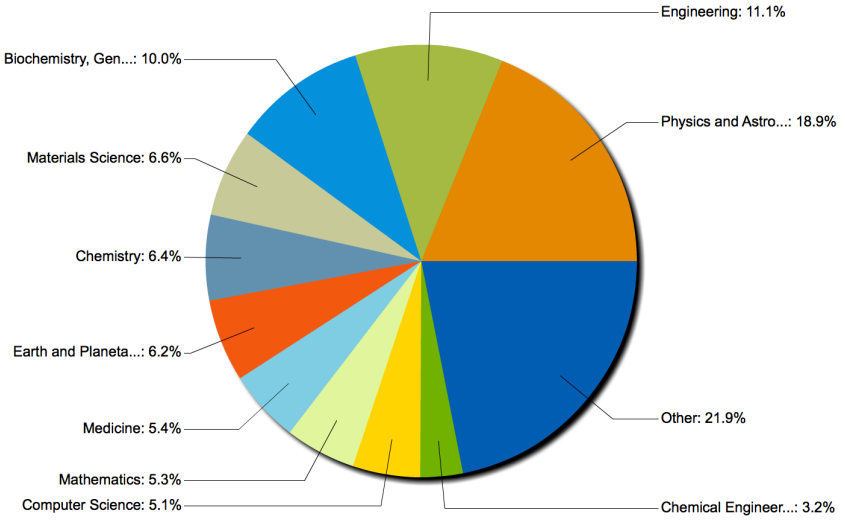
Knowledge Landscape & Network Insights



DTU Technical University of Denmark

Holistic knowledge mapping VS counting

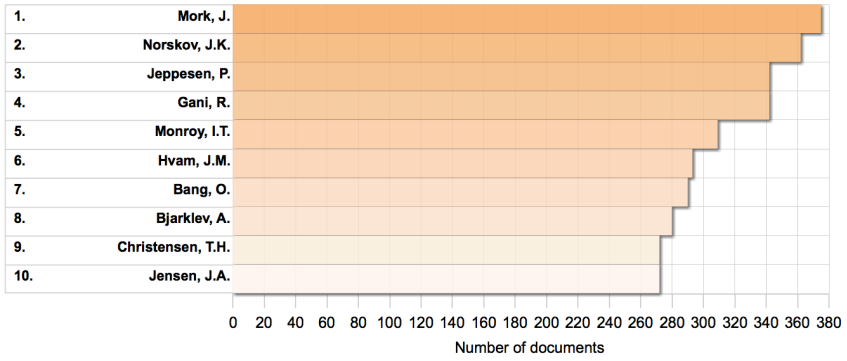




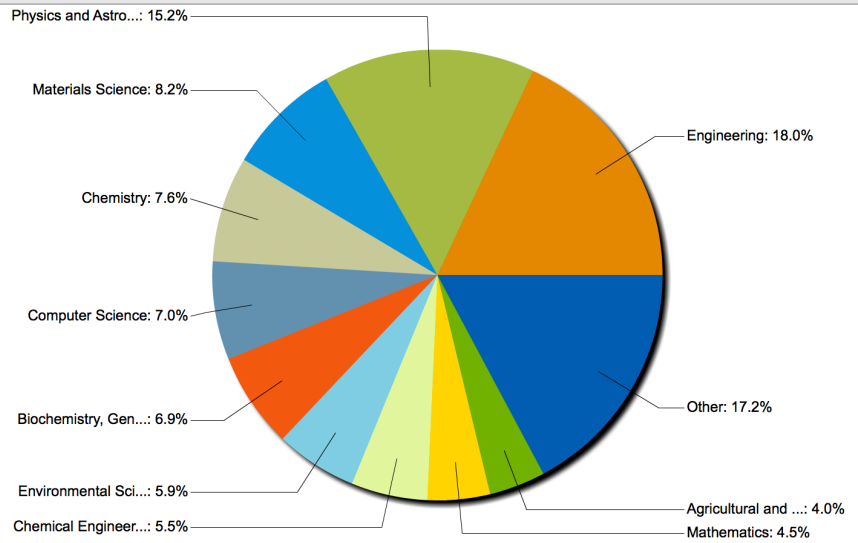
Holistic knowledge mapping VS counting

DTU

Author name This chart shows the total number of documents for this query by Author.

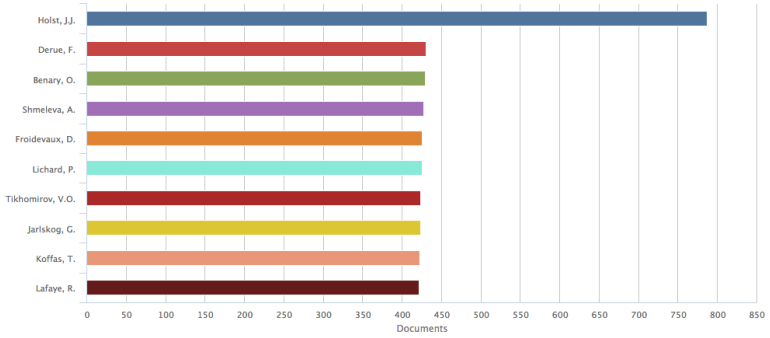


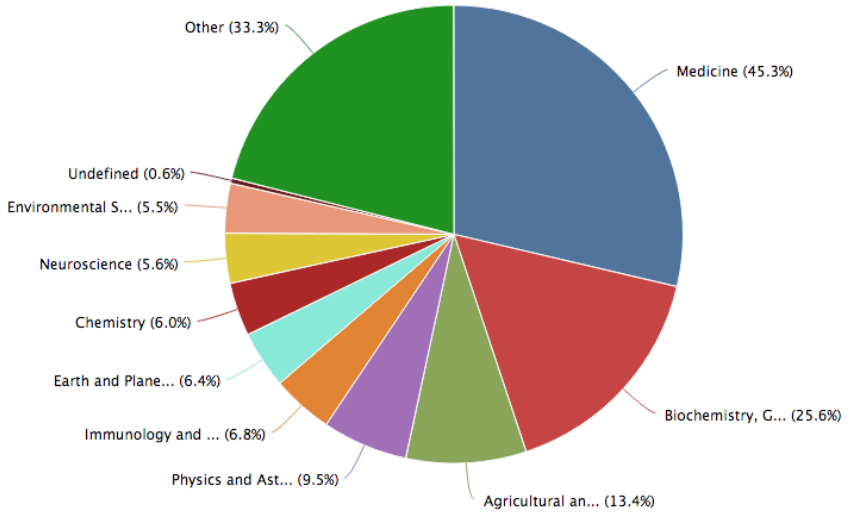
Subject Areas This chart shows the total number of documents for this query by Subject Area.



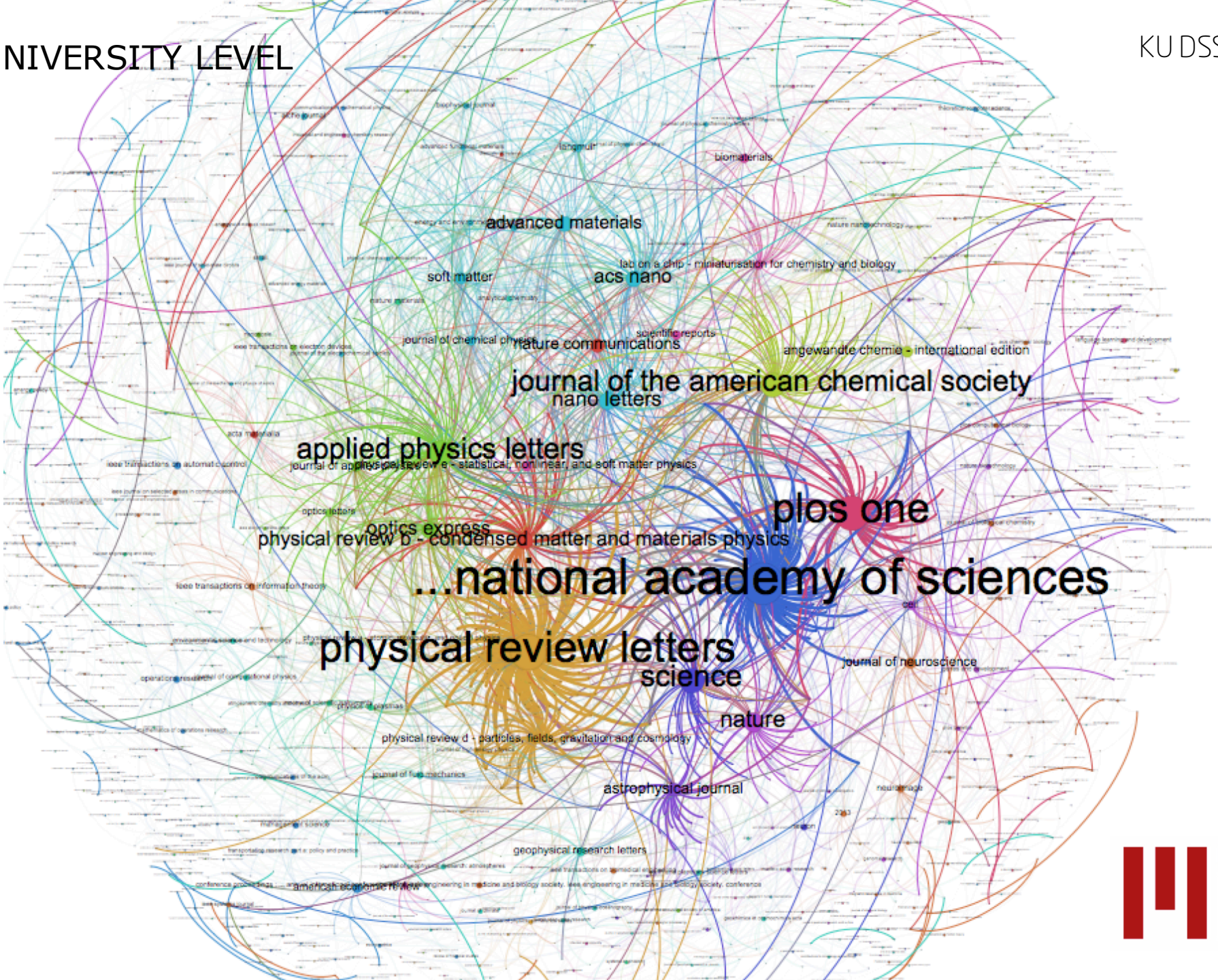
Holistic knowledge mapping VS counting

UNIVERSITY OF COPENHAGEN

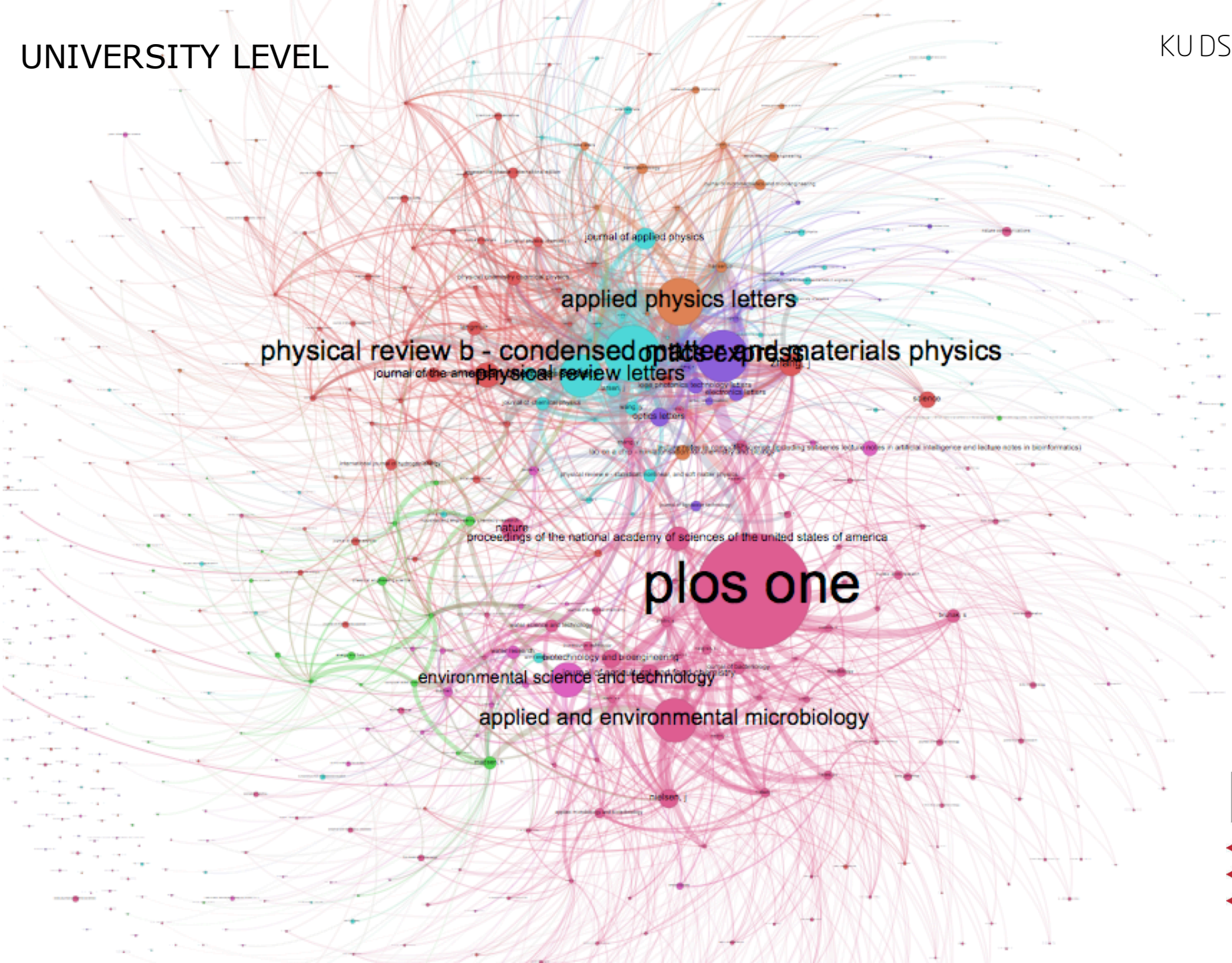




UNIVERSITY LEVEL

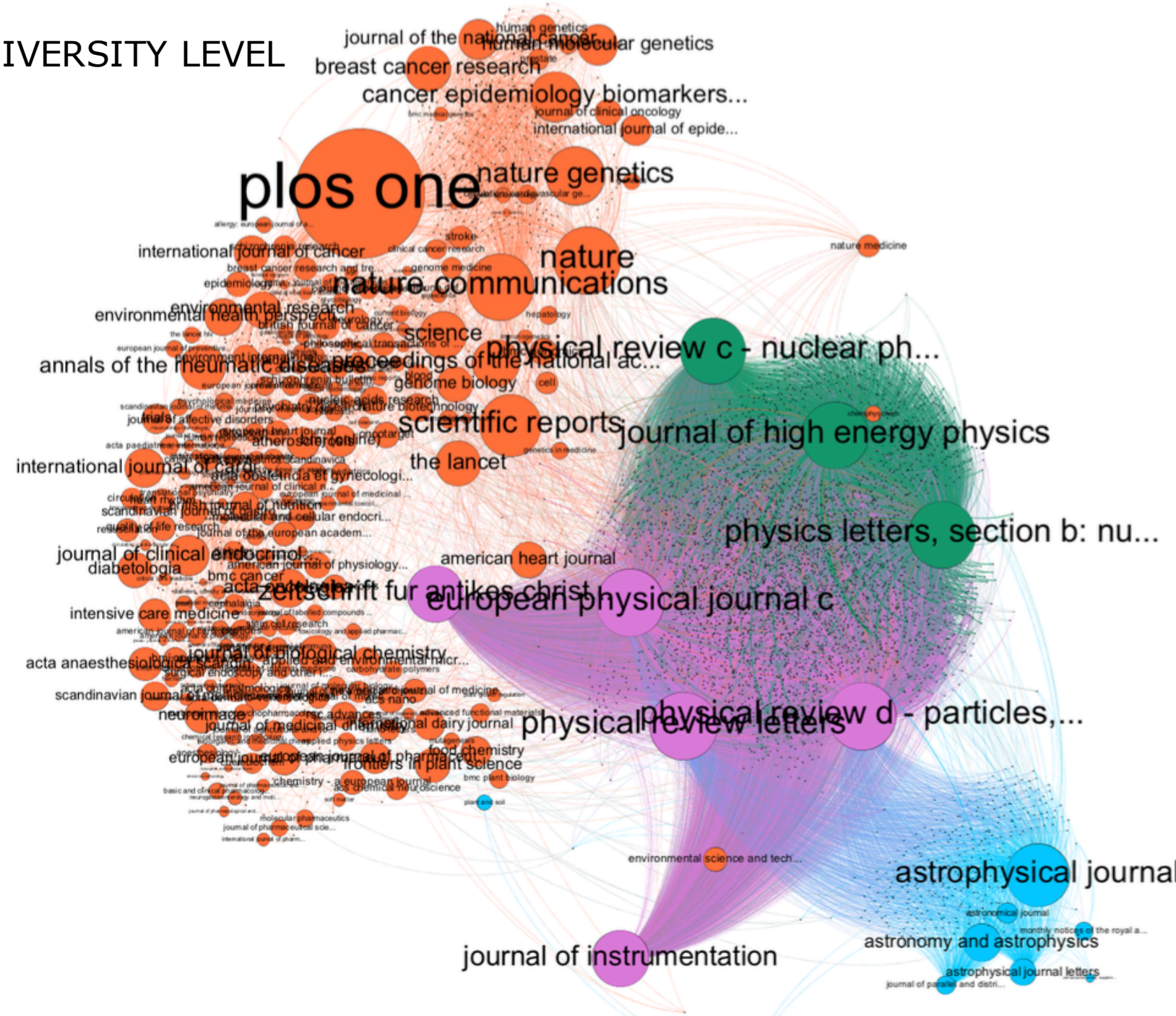


UNIVERSITY LEVEL



UNIVERSITY LEVEL

KU DSSL, 18th Feb 2016



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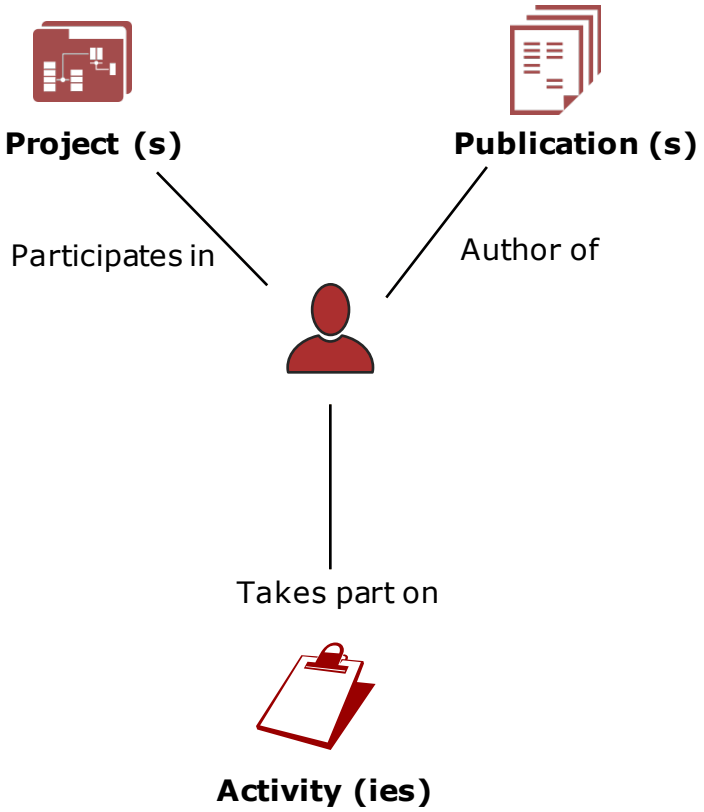
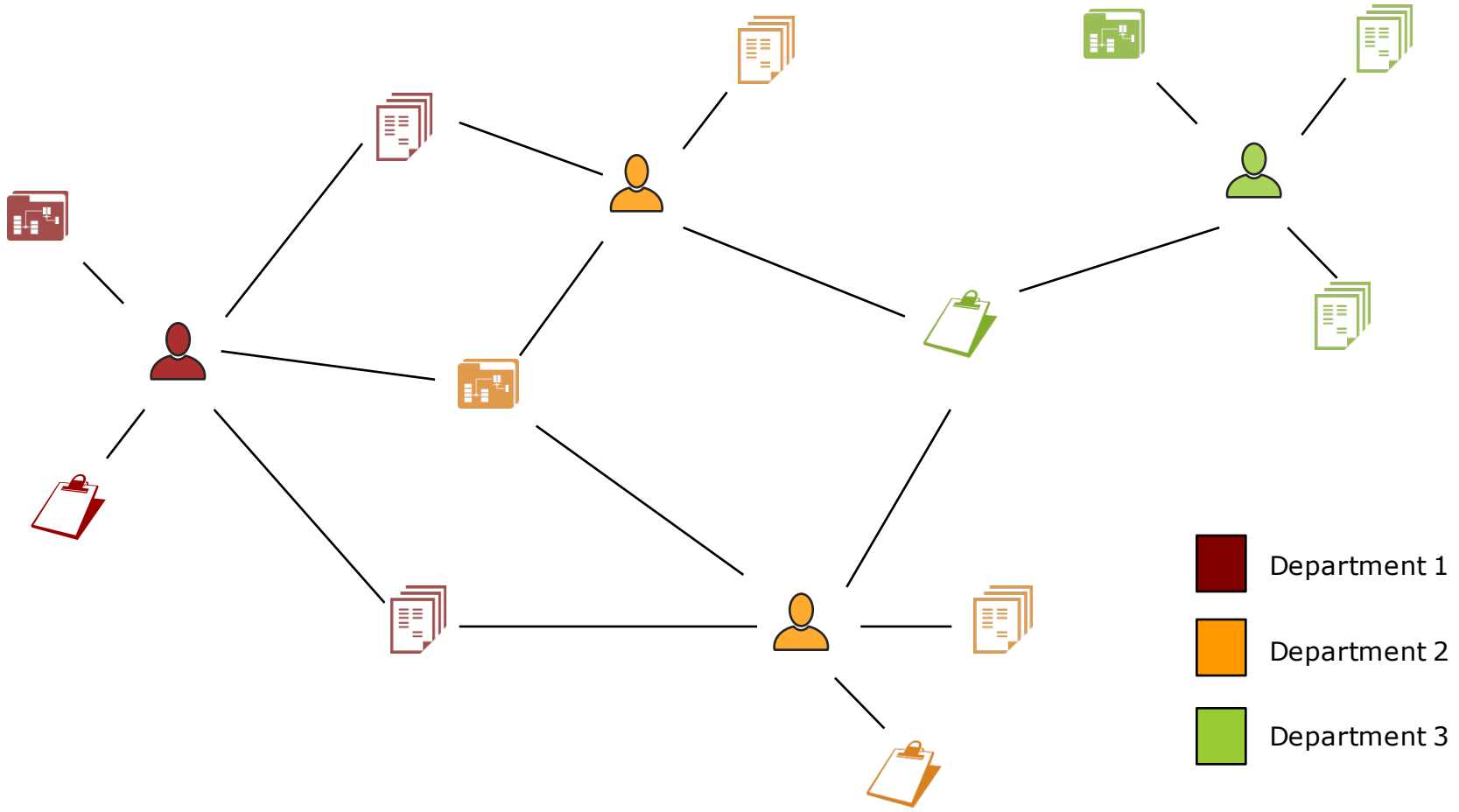
Baseline network model

Knowledge Landscape



Baseline network model

Knowledge Landscape



Source Data

Knowledge Landscape

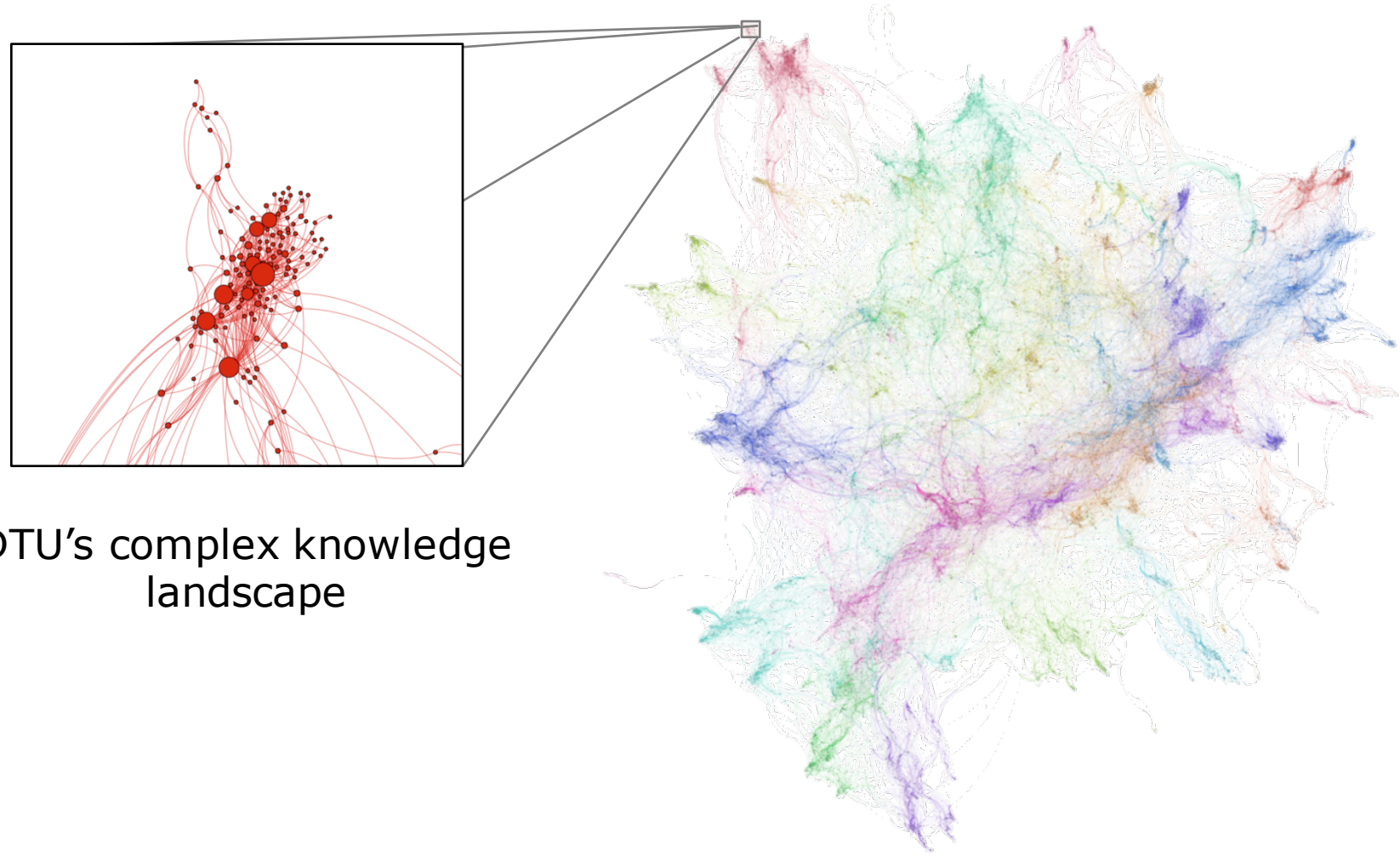
ORBIT

2009 - 2015

Entitity Type	
Activities	655
People	7,293
Projects	7,472
Publications	13,256

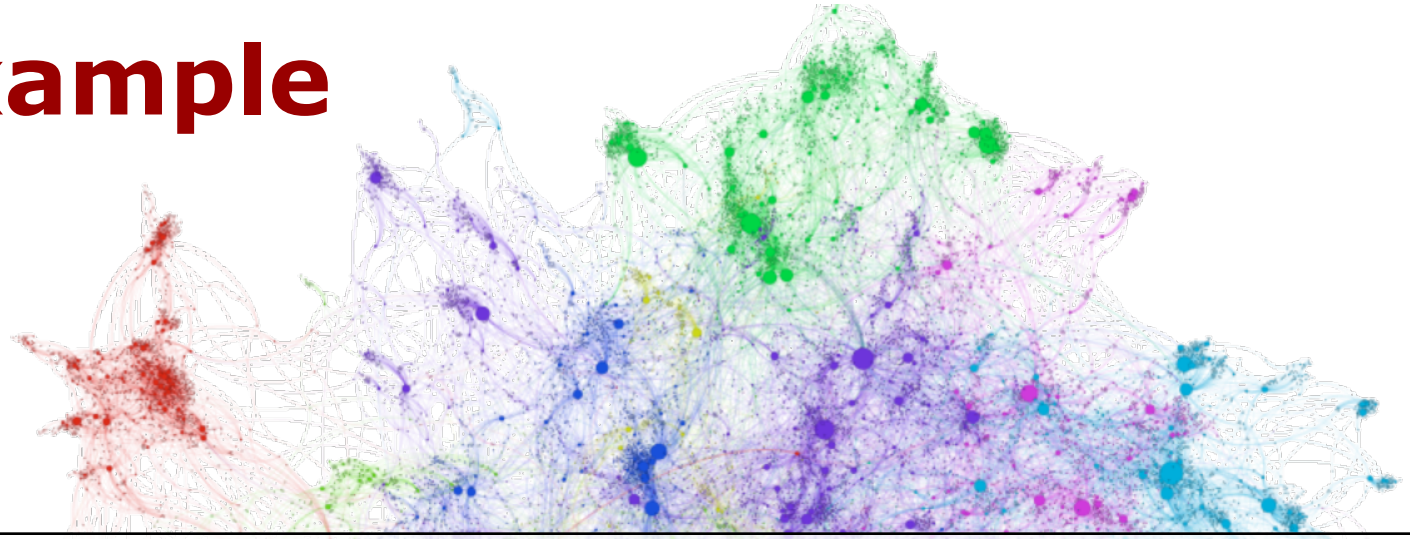
A networked and systemic perspective

Actual network model with 25.333 entities



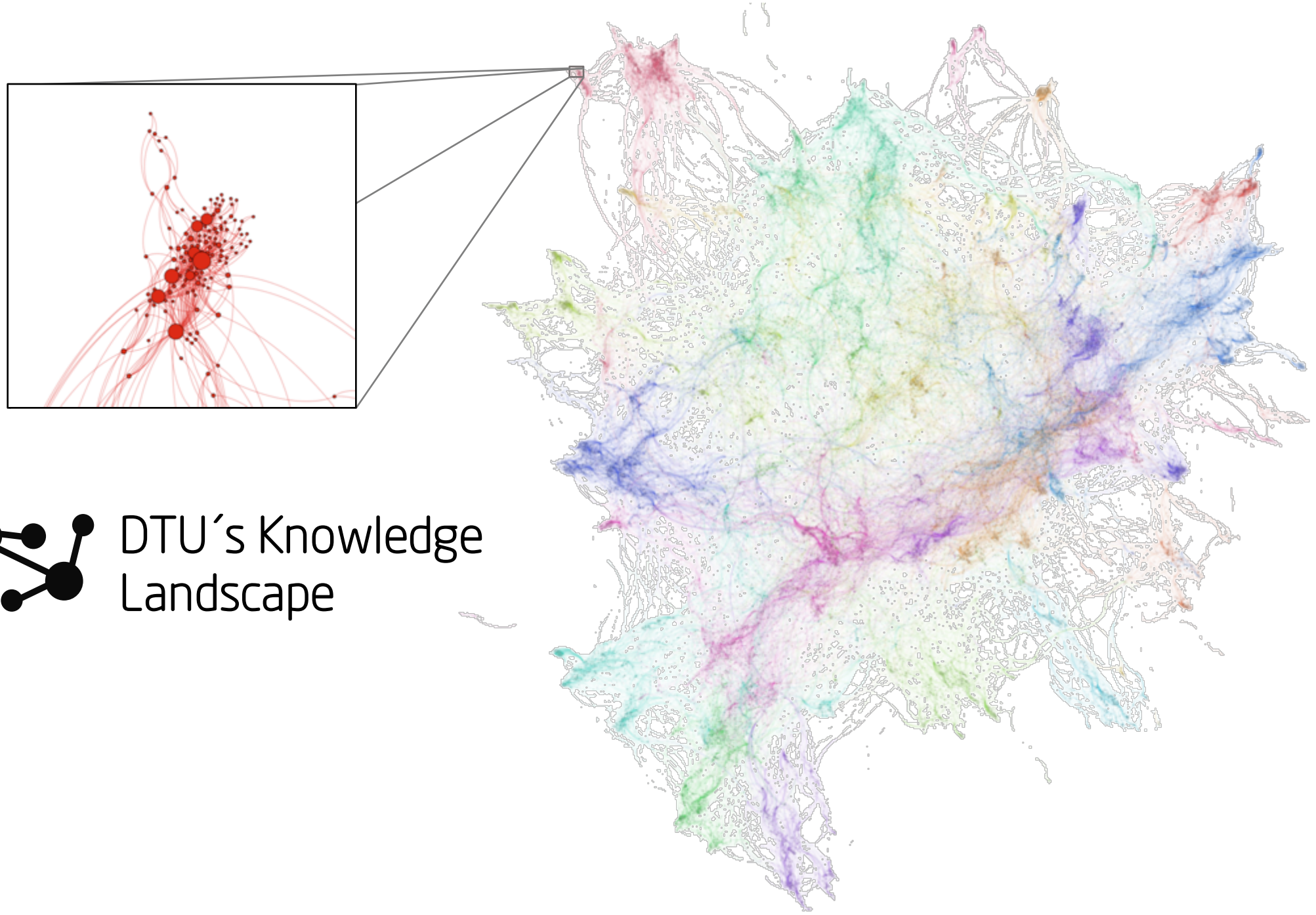
DTU's complex knowledge landscape

Example



- **25.000**+ entities
  (∑ of people, projects, publications and activities)

- **73.000**+ relationships between the entities



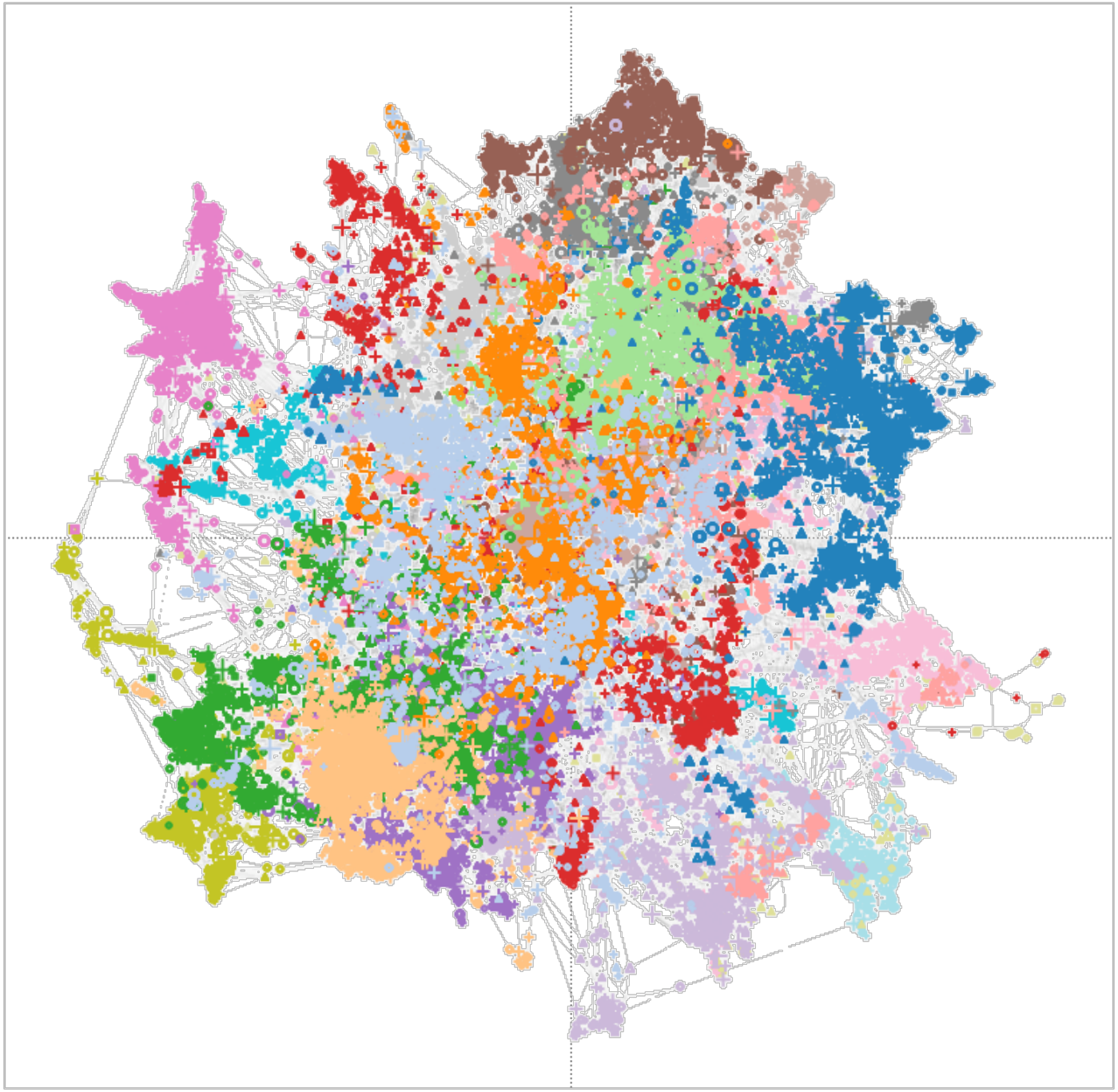
DTU´s Knowledge Landscape

Danmarks Tekniske Universitet

Department

- Fotonik
- Compute
- Chemical Engin..
- Environment
- Food
- Nanotech
- Electrical Engin..
- Mechanical Engi..
- Systems Biology
- Management En..
- Energy
- Wind
- Aqua
- Civil Engineering
- Physics
- Chemistry
- Vet
- Others
- Space
- Transport
- Center for Electr..
- National Laborat..
- Center for Nucle..
- Biosustain
- DTU Danchip

Overall Knowledge Landscape



Entitity Type

- (All)
- Activity
- Person
- Project
- Publication

Description searc..

Refine descriptio..

Name search

Connections

2
50
100
150
200
233

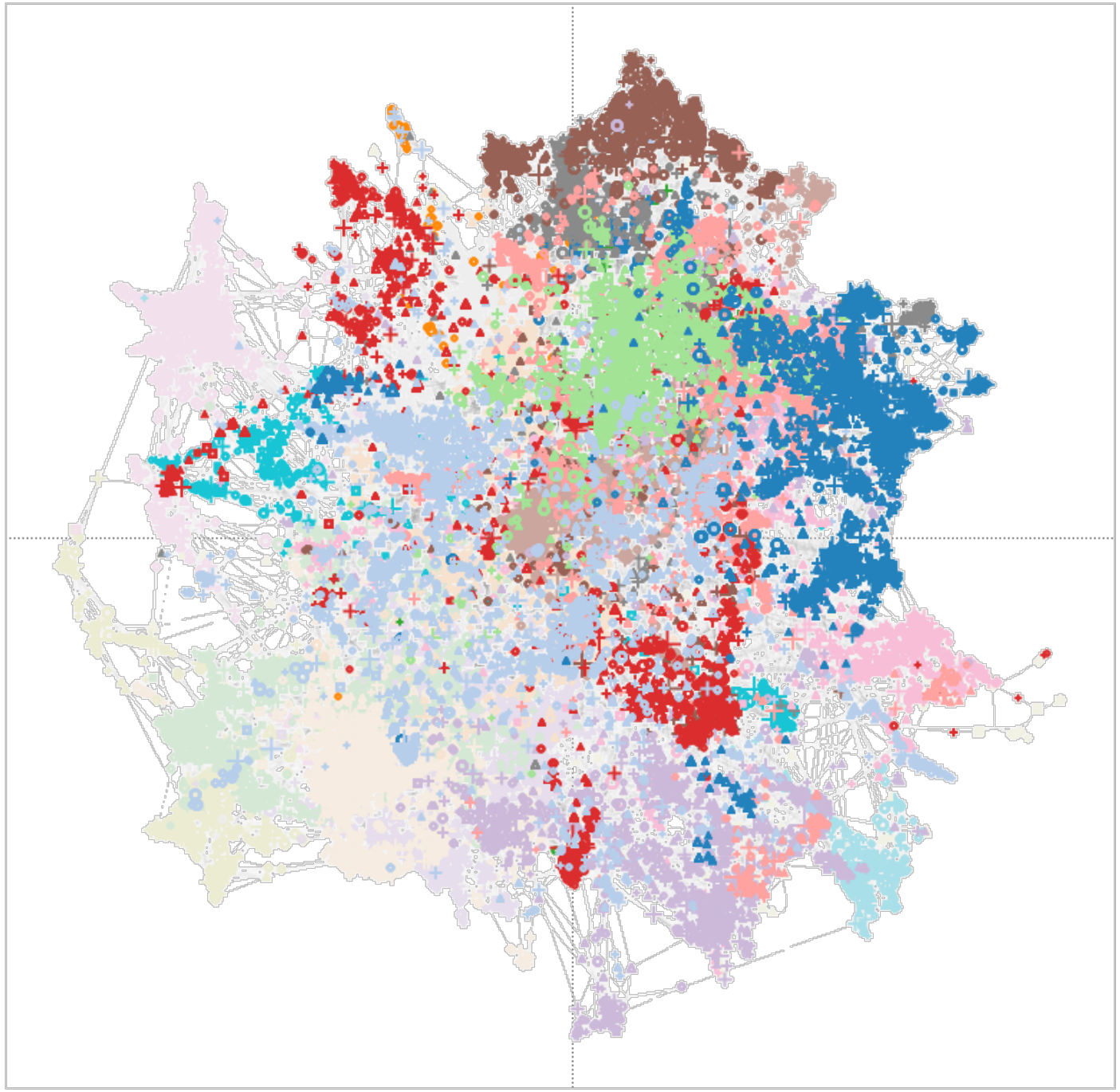
Entitity Type

- Activity
- Person
- Project
- Publication

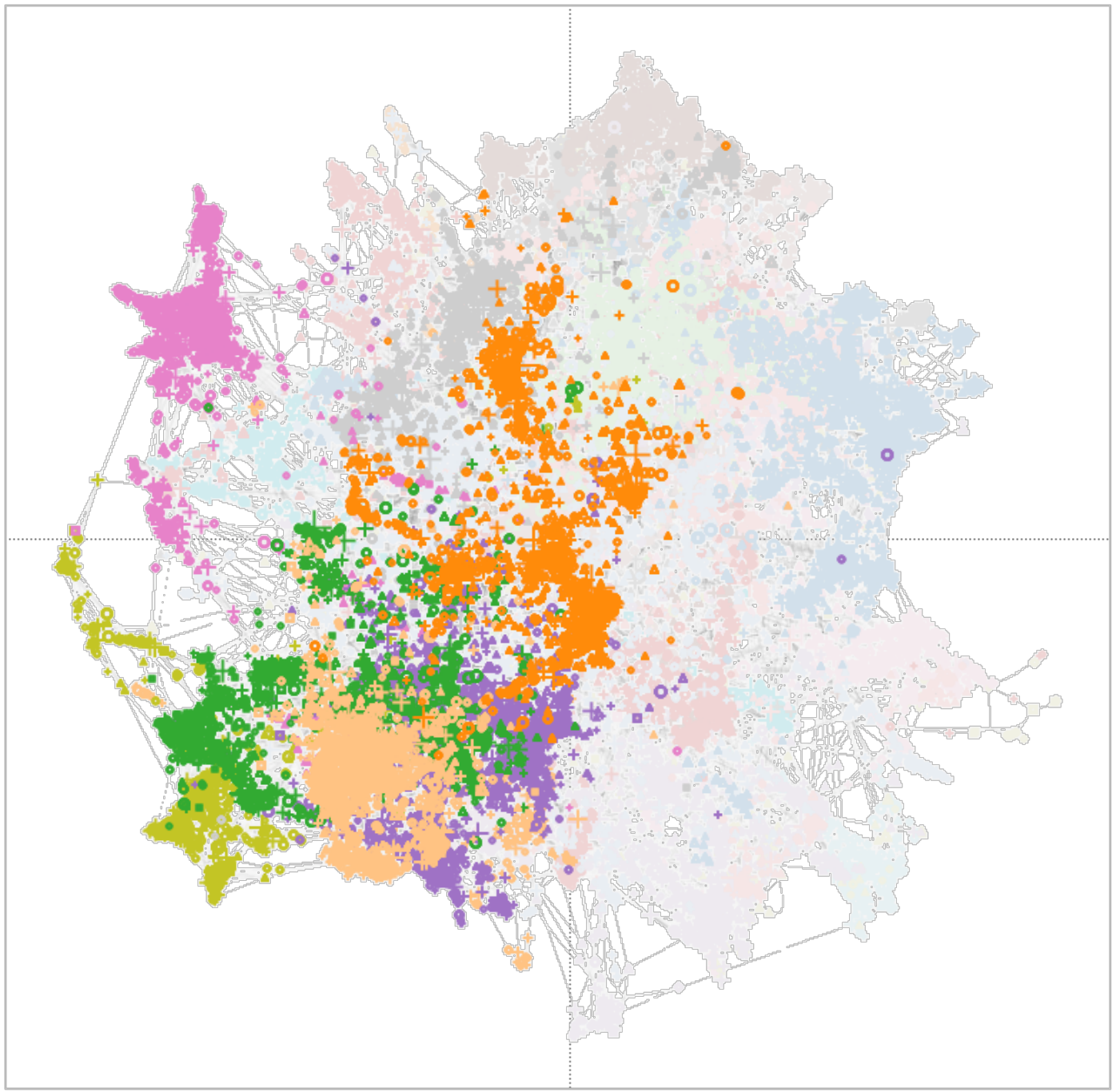
Connections

2 233

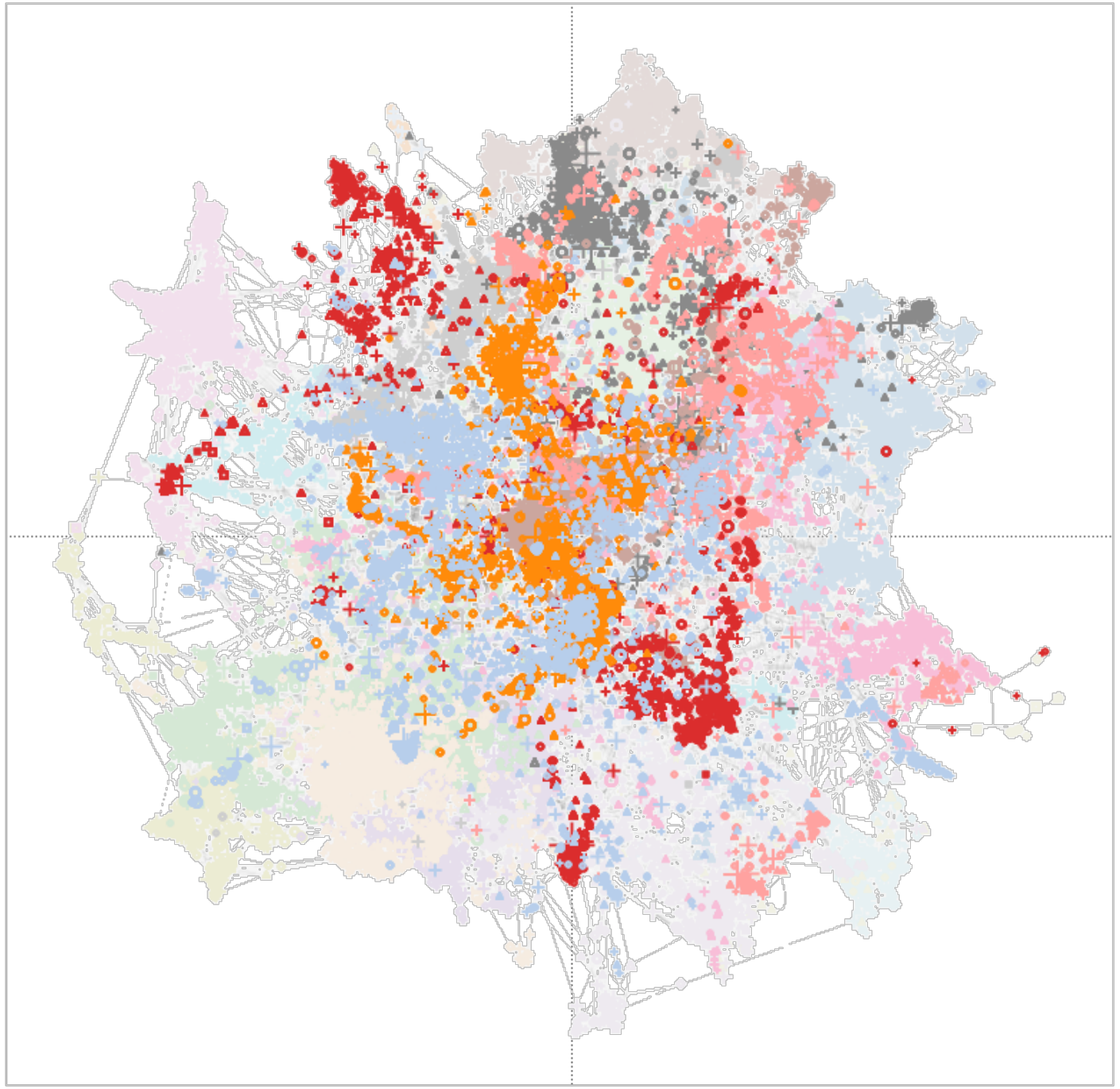
Overall Knowledge Landscape "Dry Labs"



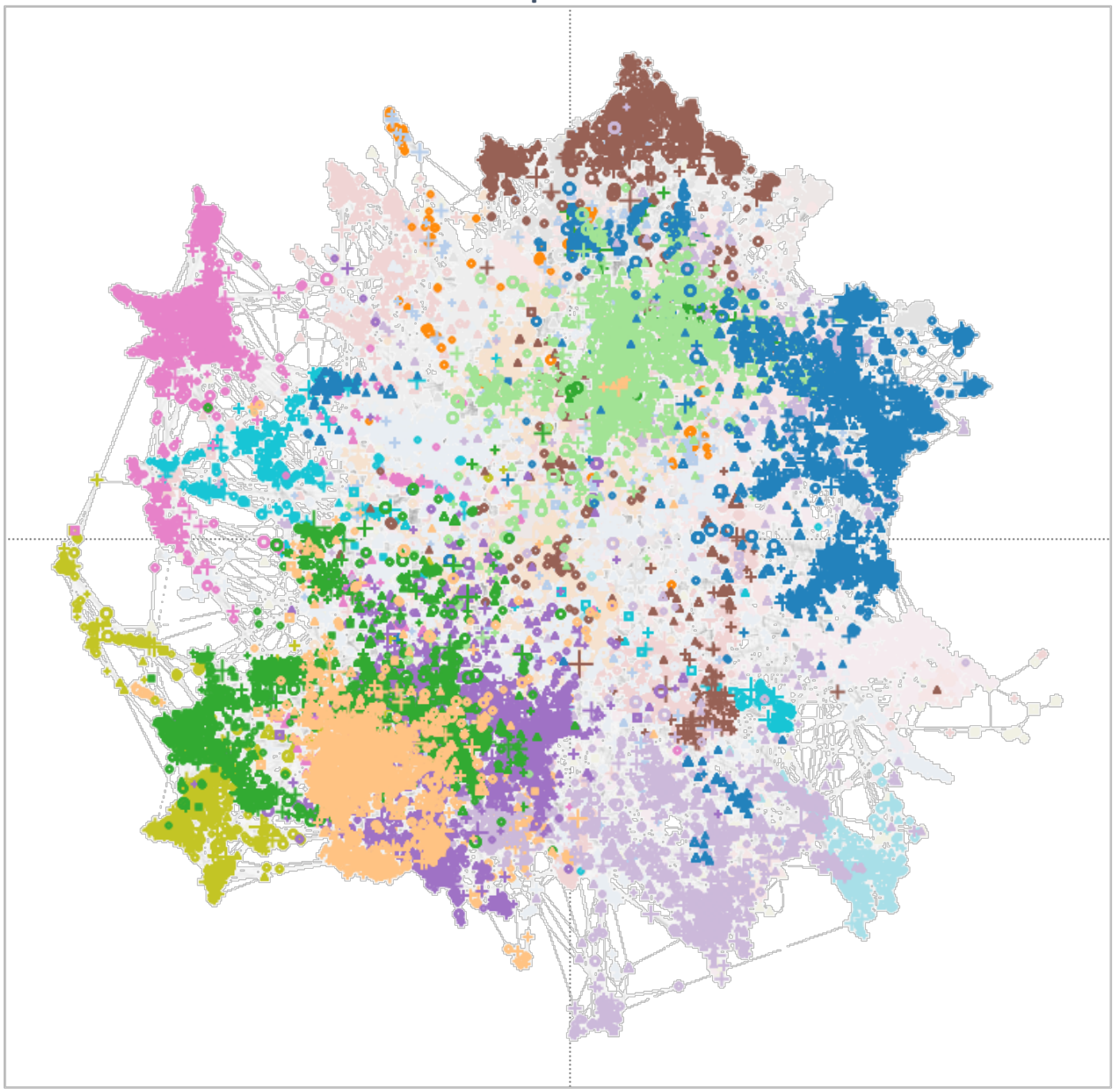
Overall Knowledge Landscape "Wet Labs"



Overall Knowledge Landscape “Distributed” Departments



Overall Knowledge Landscape "Focused" Departments



Department
- Fotonik
- Computa
- Chemical Engin..
- Environment
- Food
- Nanotech
- Electrical Engin..
- Mechanical Engi..
- Systems Biology
- Management En..
- Energy
- Wind
- Aqua
- Civil Engineering
- Physics
- Chemistry
- Vet
- Others
- Space
- Transport
- Center for Electr..
- National Laborat..
- Center for Nucle..
- Biosustain
- DTU Danchip

Entitity Type
- (All)
- Activity
- Person
- Project
- Publication

Description searc..

Refine descriptio..

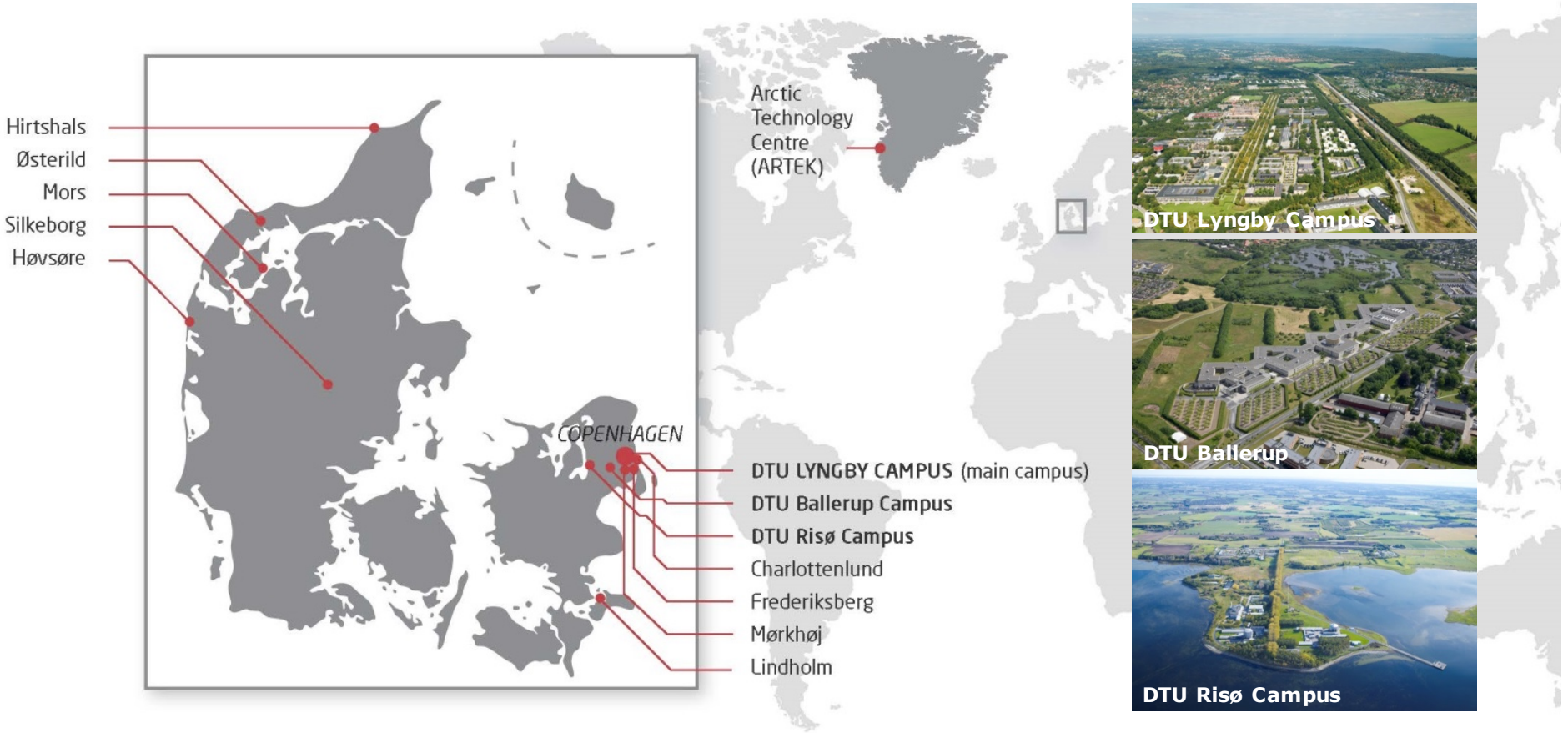
Name search

Connections
2
50
100
150
200
233

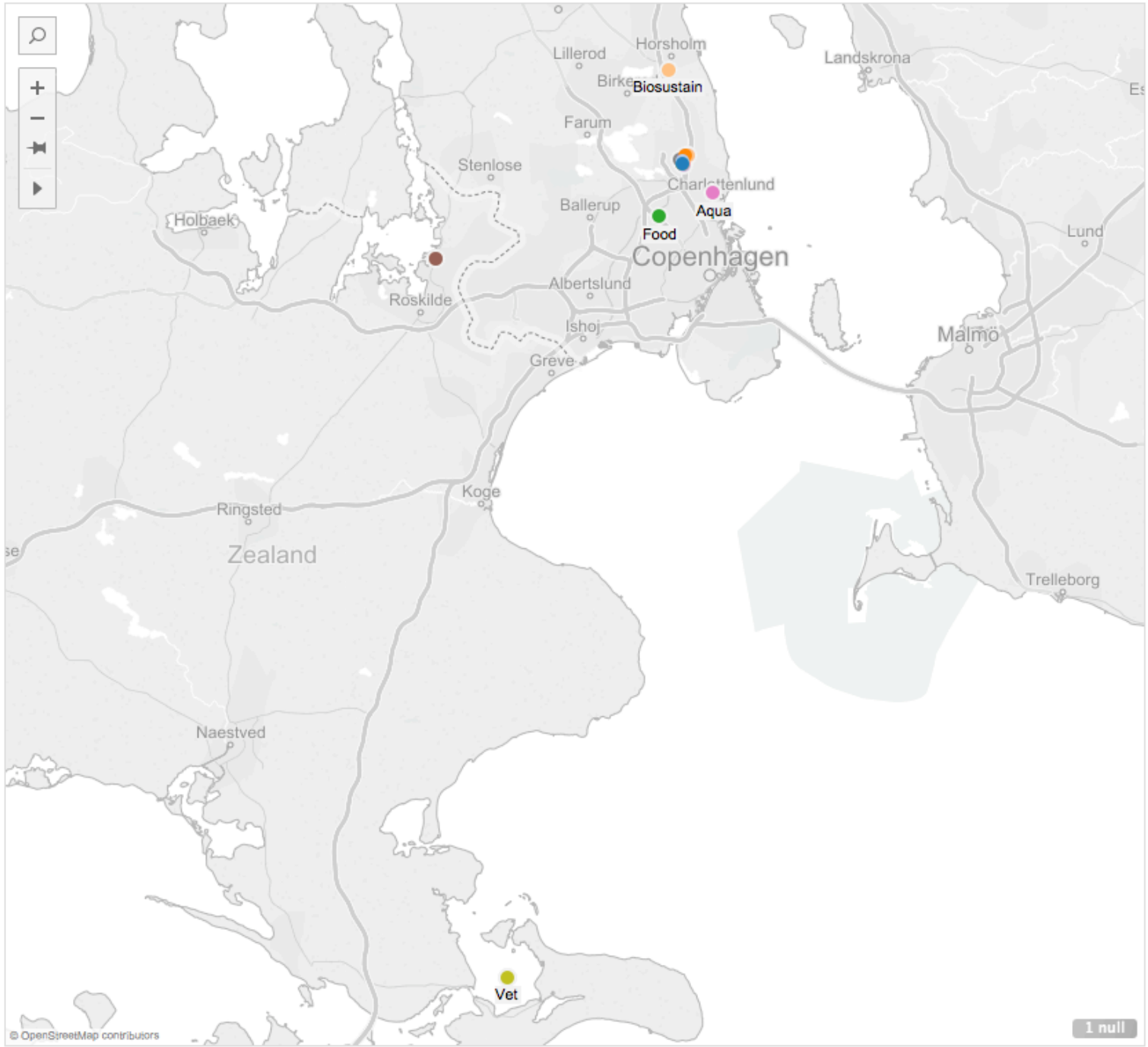
Entitity Type
- Activity
- Person
- Project
- Publication

Connections
2 233

One university



Geo Map



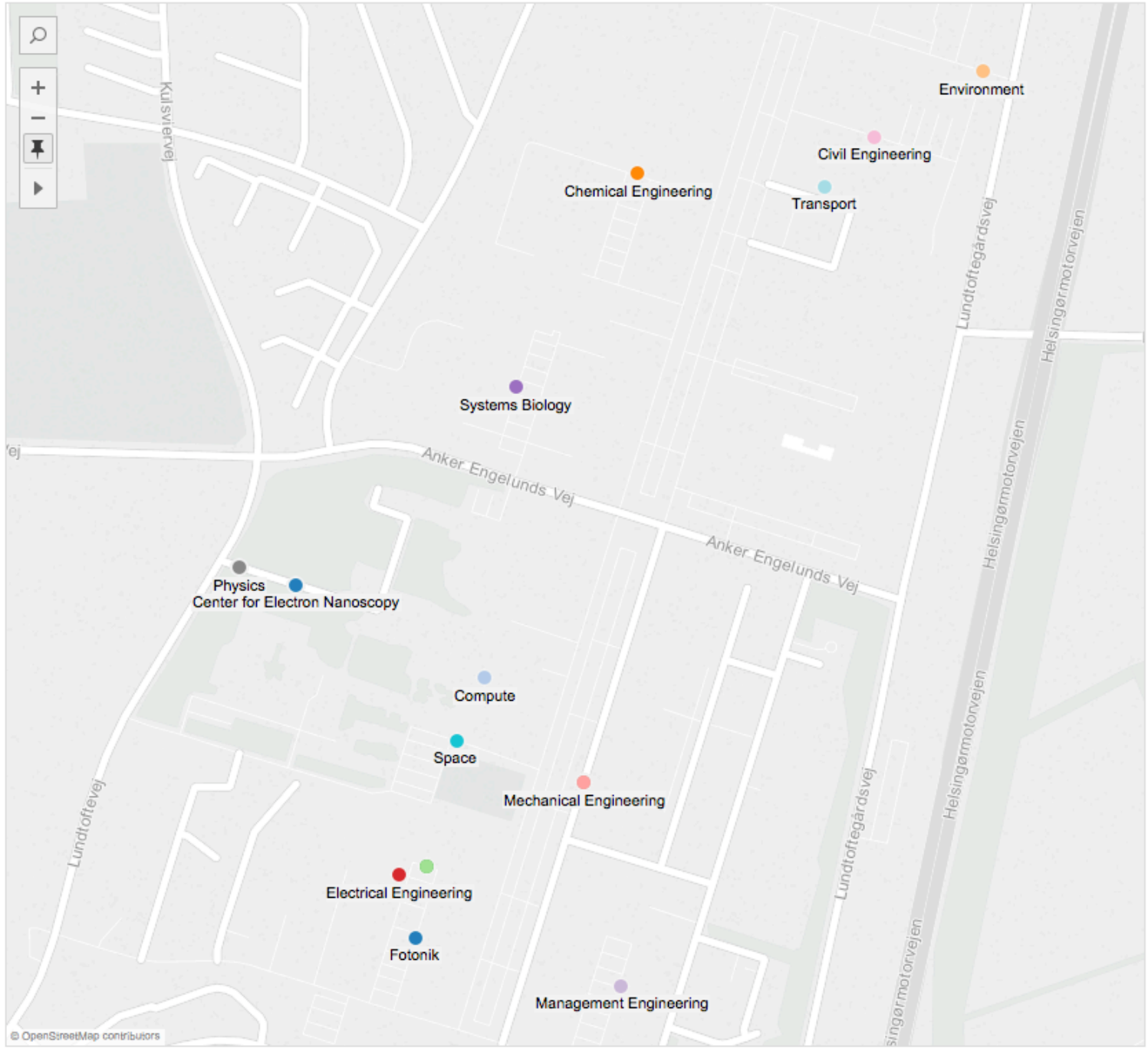
Owner (group)

- Fotonik
- Compute
- Chemical Engineering
- Environment
- Food
- Nanotech
- Electrical Engineering
- Mechanical Engineering
- Systems Biology
- Management Engineeri..
- Energy
- Wind
- Aqua
- Civil Engineering
- Physics
- Chemistry
- Vet
- Others
- Space
- Transport
- Center for Electron Nan..
- National Laboratory for ..
- Center for Nuclear Tec..
- Biosustain
- DTU Danchip

Department filter

(All)

Geo Map

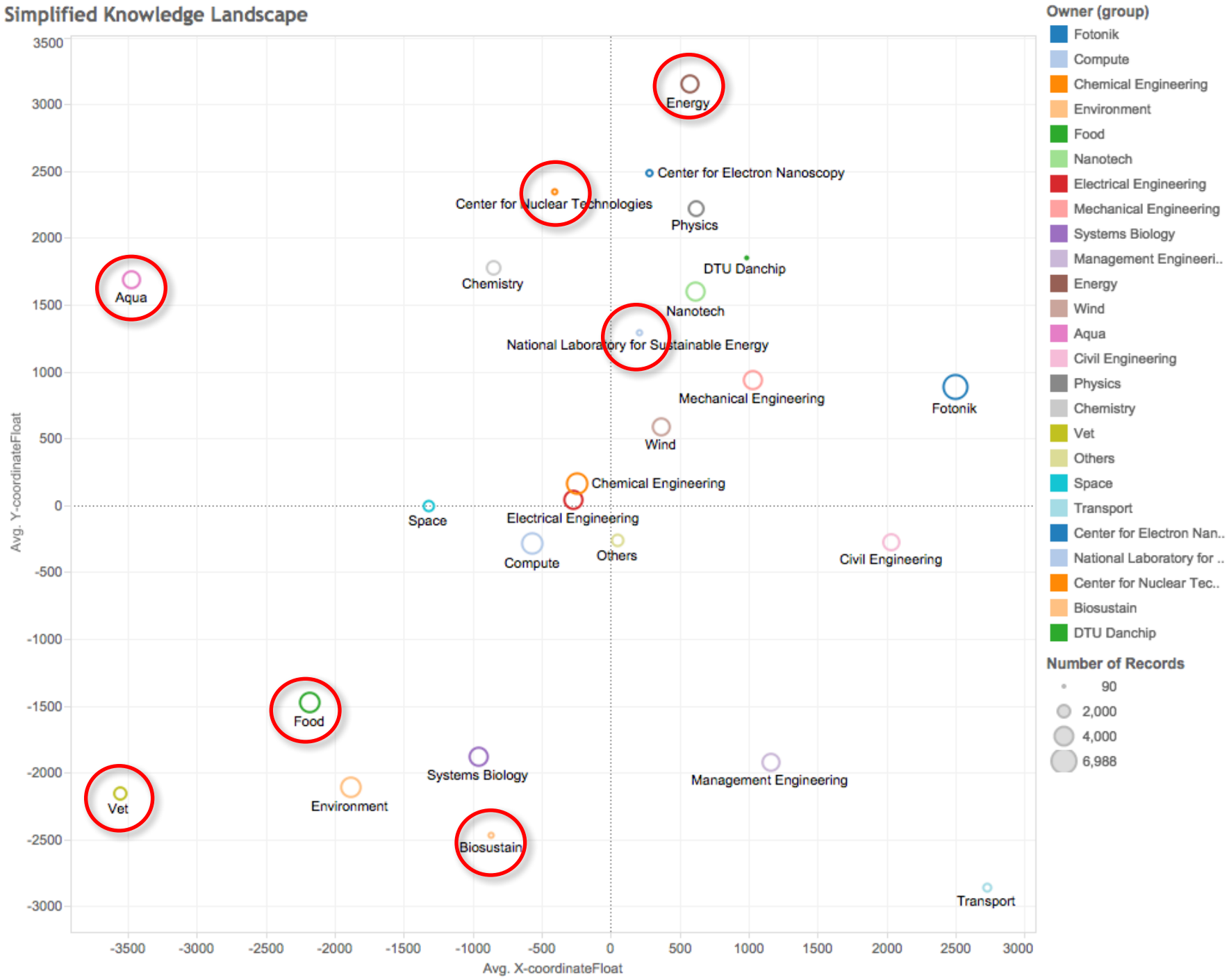


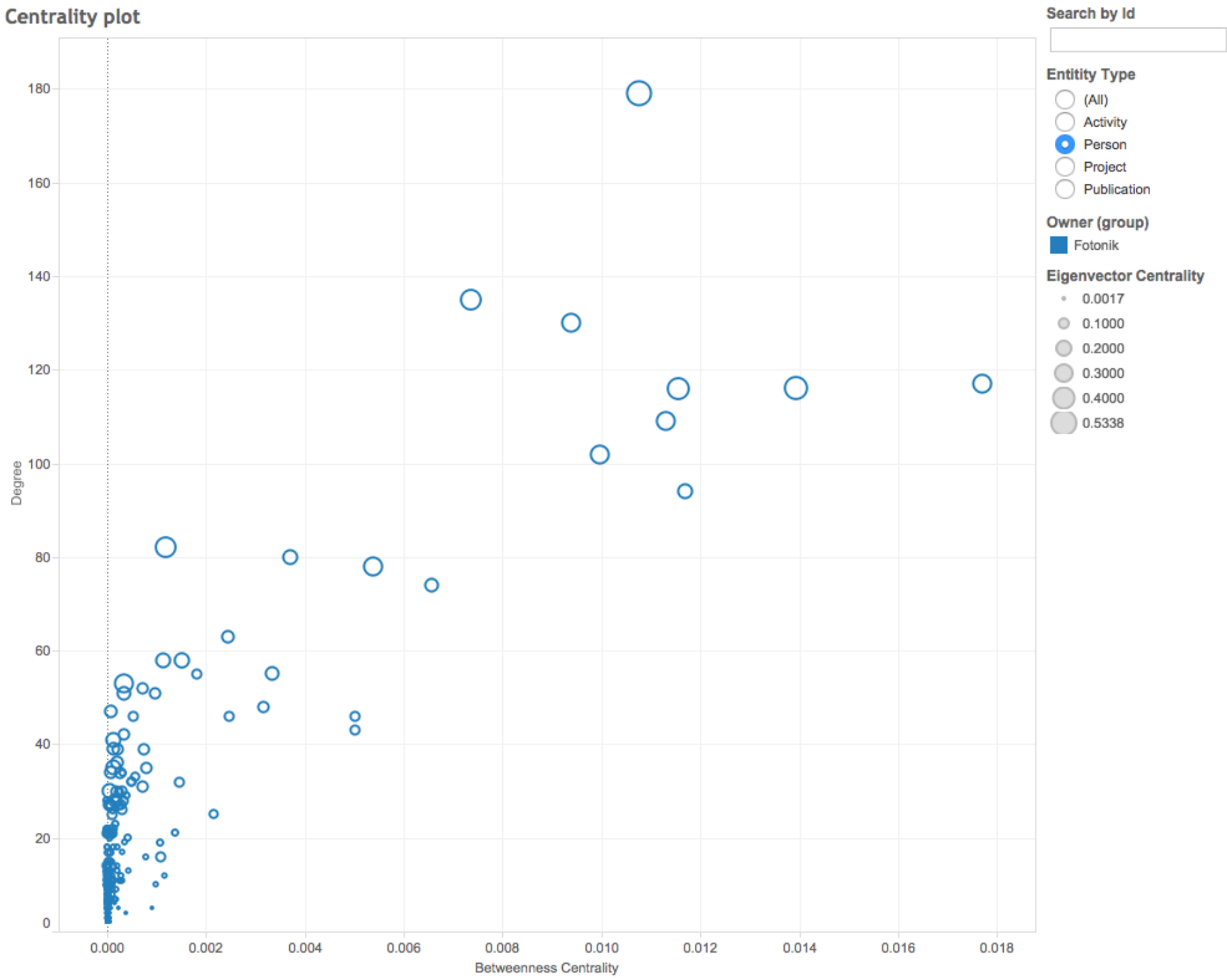
Owner (group)

- Fotonik
- Compute
- Chemical Engineering
- Environment
- Nanotech
- Electrical Engineering
- Mechanical Engineering
- Systems Biology
- Management Engineeri..
- Wind
- Civil Engineering
- Physics
- Chemistry
- Space
- Transport
- Center for Electron Nan..
- DTU Danchip

Department filter

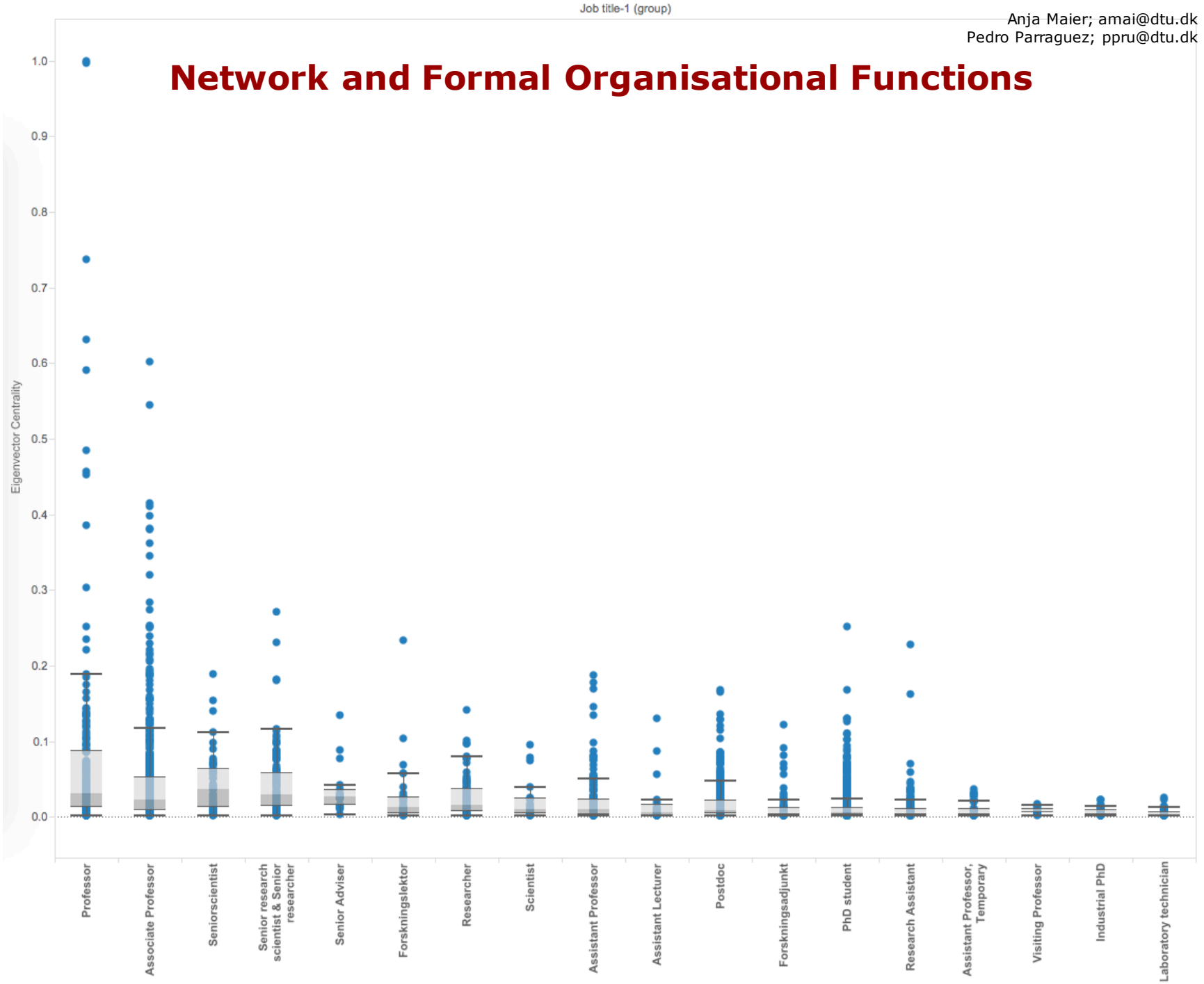
(All)

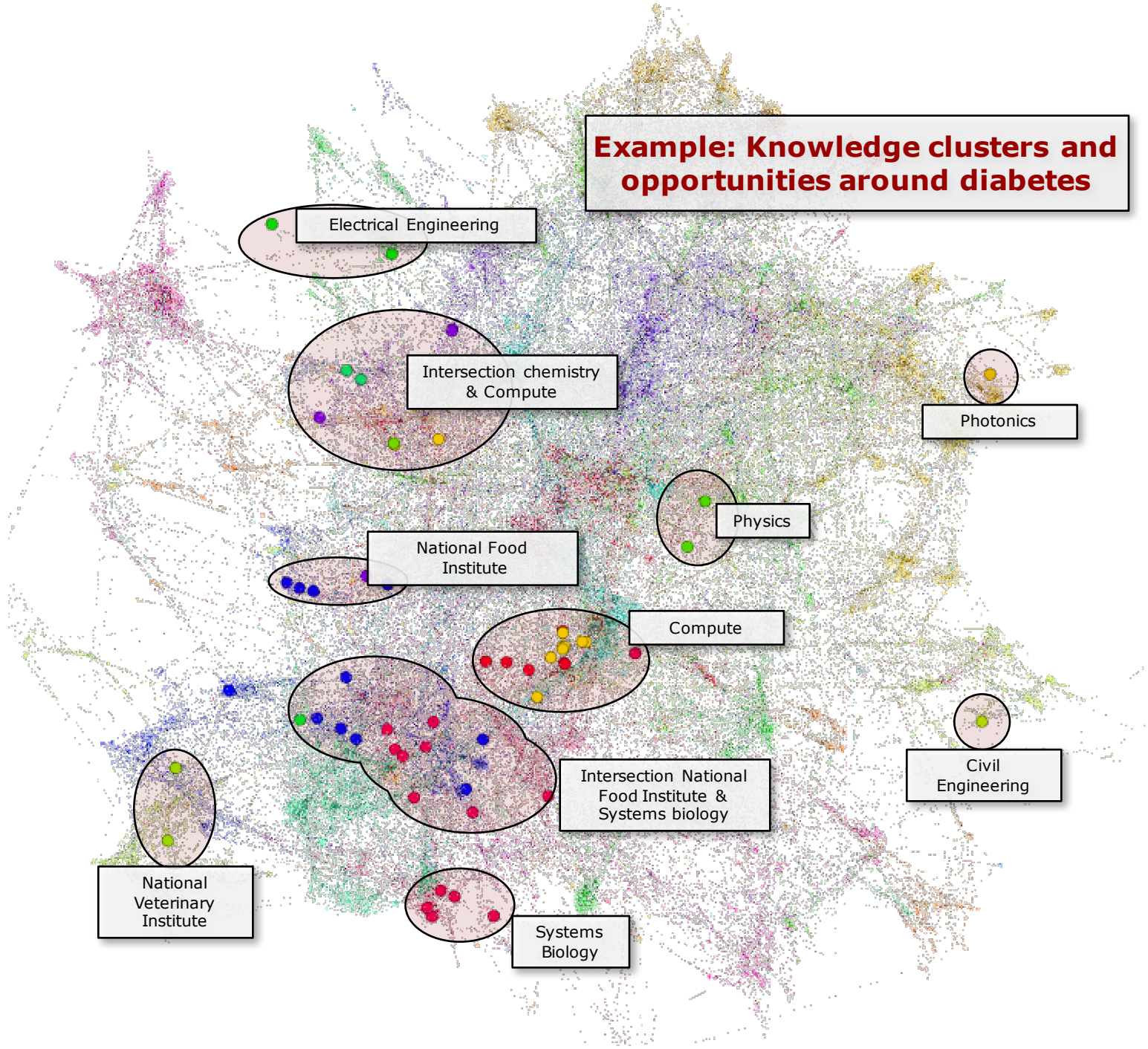

Simplified Knowledge Landscape
Avg. Y-coordinateFloat
Avg. X-coordinateFloat
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-3000
-2500
-2000
-1500
-1000
-500
0
500
1000
1500
2000
2500
3000
Energy
Center for Electron Nanoscopy
Center for Nuclear Technologies
Physics
Chemistry
DTU Danchip
Aqua
Nanotech
National Laboratory for Sustainable Energy
Mechanical Engineering
Fotonik
Wind
Chemical Engineering
Space
Electrical Engineering
Compute
Others
Civil Engineering
Food
Systems Biology
Management Engineering
Vet
Environment
Biosustain
Transport
Owner (group)
Fotonik
Compute
Chemical Engineering
Environment
Food
Nanotech
Electrical Engineering
Mechanical Engineering
Systems Biology
Management Engineeri..
Energy
Wind
Aqua
Civil Engineering
Physics
Chemistry
Vet
Others
Space
Transport
Center for Electron Nan..
National Laboratory for ..
Center for Nuclear Tec..
Biosustain
DTU Danchip
Number of Records
90
2,000
4,000
6,988

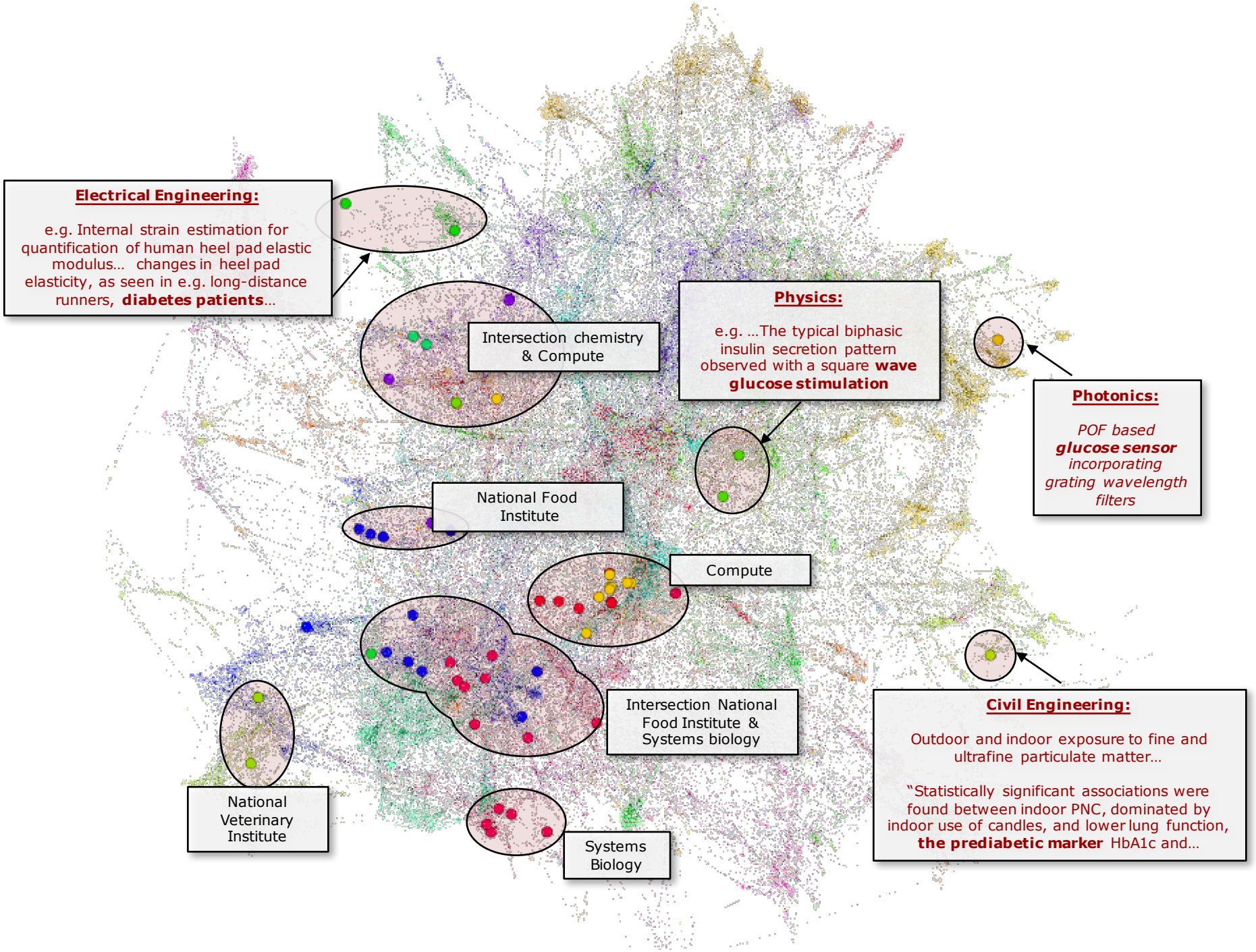

Centrality plot
Search by Id
Entitity Type
(All)
Activity
Person
Project
Publication
Owner (group)
Fotonik
Eigenvector Centrality
0.0017
0.1000
0.2000
0.3000
0.4000
0.5338
Degree
0
20
40
60
80
100
120
140
160
180
0.000
0.002
0.004
0.006
0.008
0.010
0.012
0.014
0.016
0.018
Betweenness Centrality

Anja Maier; amai@dtu.dk
Pedro Parraguez; ppru@dtu.dk

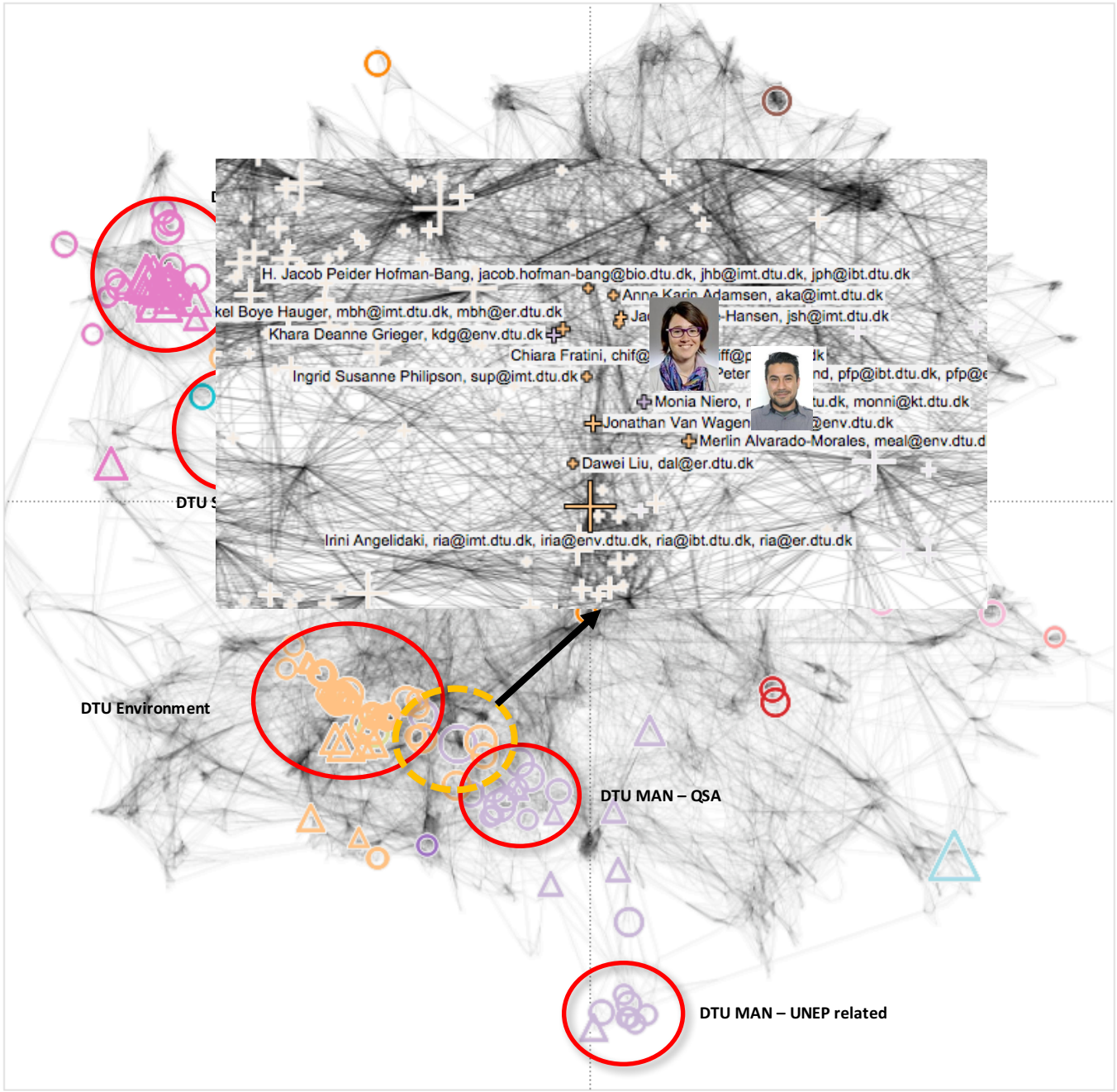
Network and Formal Organisational Functions




Example: Knowledge clusters and opportunities around diabetes
Electrical Engineering
Intersection chemistry & Compute
Photonics
Physics
National Food Institute
Compute
Intersection National Food Institute & Systems biology
Civil Engineering
National Veterinary Institute
Systems Biology


Electrical Engineering:
e.g. Internal strain estimation for quantification of human heel pad elastic modulus… changes in heel pad elasticity, as seen in e.g. long-distance runners, diabetes patients…
Intersection chemistry & Compute
Physics:
e.g. …The typical biphasic insulin secretion pattern observed with a square wave glucose stimulation
Photonics:
POF based glucose sensor incorporating grating wavelength filters
National Food Institute
Compute
Intersection National Food Institute & Systems biology
Civil Engineering:
Outdoor and indoor exposure to fine and ultrafine particulate matter…
"Statistically significant associations were found between indoor PNC, dominated by indoor use of candles, and lower lung function, the prediabetic marker HbA1c and…
National Veterinary Institute
Systems Biology

Overall Knowledge Landscape : “Climate Change”



Entitity Type

- (All)
- Activity
- Person
- Project
- Publication

Description searc..

:limate change

Refine descriptio..

Name search

 # Connections

2
5
10
15

Entitity Type

- Project
- Publication

 # Connections

2 — 15

Department

- Environment
- Aqua
- Management En..
- Chemical Engin..
- Civil Engineering
- Space
- Transport
- Electrical Engin..
- Others
- Energy
- Center for Nucle..
- Mechanical Engi..
- Systems Biology

Wrap up

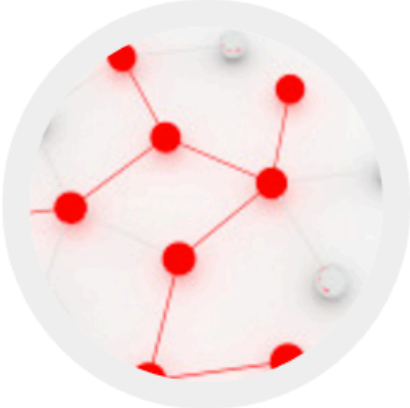
Vision and Opportunities

Net-Sights

Summary

DATA-DRIVEN

We believe in a bottom-up approach driven by large amounts of data to generate new insights



FROM COUNTING TO CONNECTING

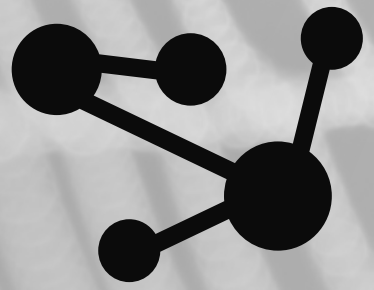
Our goal is to reveal the hidden connections and opportunities between otherwise disconnected possibilities

FROM ORGANISATIONS TO ECOSYSTEMS

Recombinant innovation requires to shift the focus from individual organisations to industrial ecosystems

Thanks!

Learn more at: www.netsights.dk



Net-Sights

Network Insights

Danmarks Tekniske Universitet