INTERVENANTS

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Doctorant
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ILNAS-SnT Research Programme and Other Developments

Dr. Grégoire Danoy

Research Scientist, Deputy Head PCO Group

University of Luxembourg

Parallel Computing and Optimisation Group

http://pcog.uni.lu

Research Topics:
- Parallel/Decentralised computing
- Optimisation/Search/Learning

Aim:
- Efficient, scalable and robust solutions to solve large-scale discrete/combinatorial problems.

Expertise:
- Design of novel exact approaches, evolutionary algorithms and swarm intelligence
- Implementation on massively multi-core systems (CPUs), accelerators (GPUs) and mobile systems (e.g., robots).

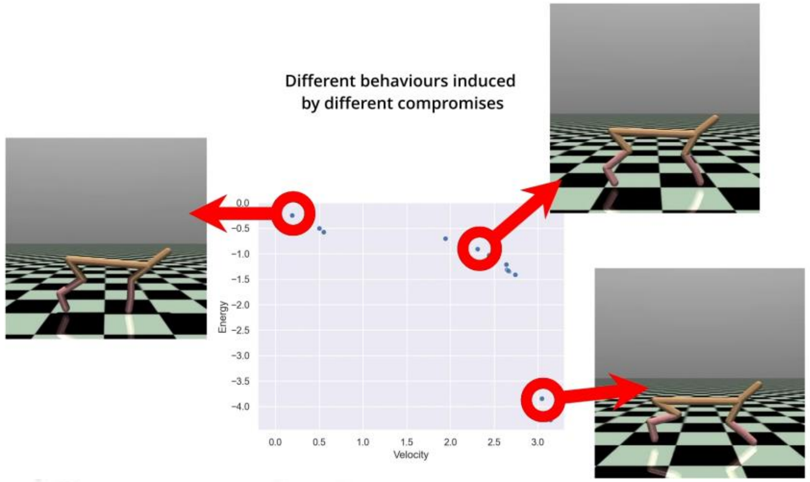
Applications:
- Robust/sustainable/efficient HPC/Grid/Cloud/IoT
- Unmanned Autonomous Systems (UAS)
- Next generation networks and protocols

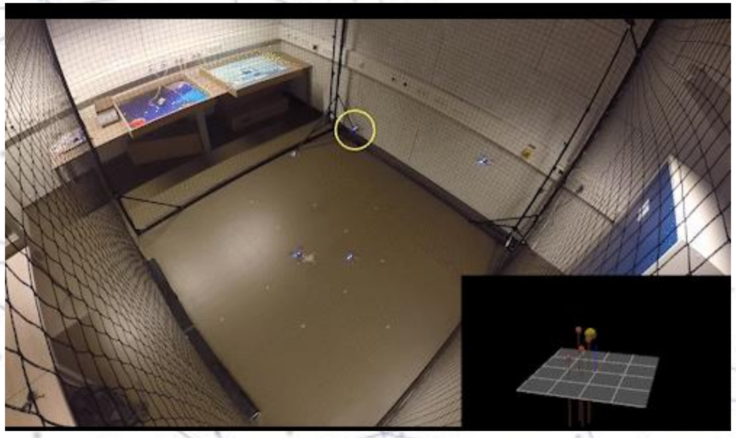
Management:
- Head: Prof. Pascal Bouvry
- Deputy Head: Dr. Grégoire Danoy

25+ researchers
1 Professor
4 Research Scientists
10 Postdocs
10 PhD students
15 nationalities

Parallel Computing and Optimisation Group

Focus Area: Parallel & Evolutionary Computing, Machine Learning, Swarm Intelligence

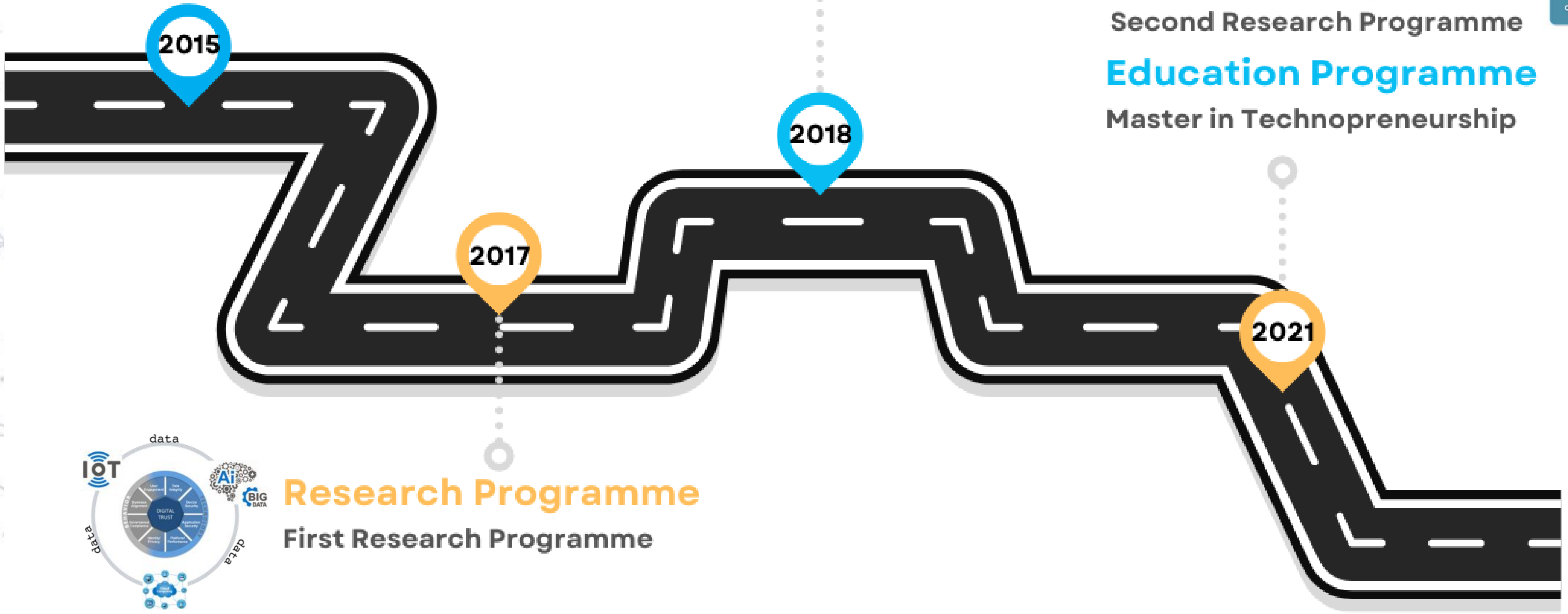




Focus Area: High-Performance Computing

ILNAS
Office of Naval Research GLOBAL Science & Technology
EUROPEAN DEFENCE AGENCY
Luxembourg National Research Fund
uni.lu SnT

Research & Education Collaboration



Education Programme
First Smart ICT Certificate

Research Programme
First Research Programme

Education Programme
Second Smart ICT Certificate

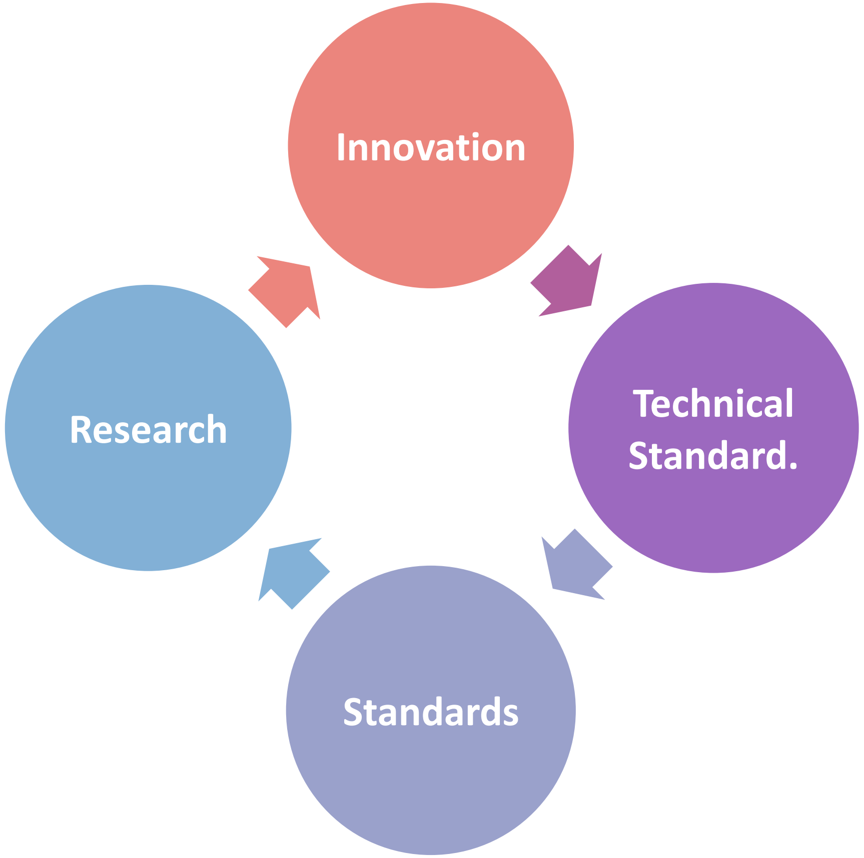
Research Programme
Second Research Programme

Education Programme
Master in Technopreneurship

Research Programme

Technical Standardization Research

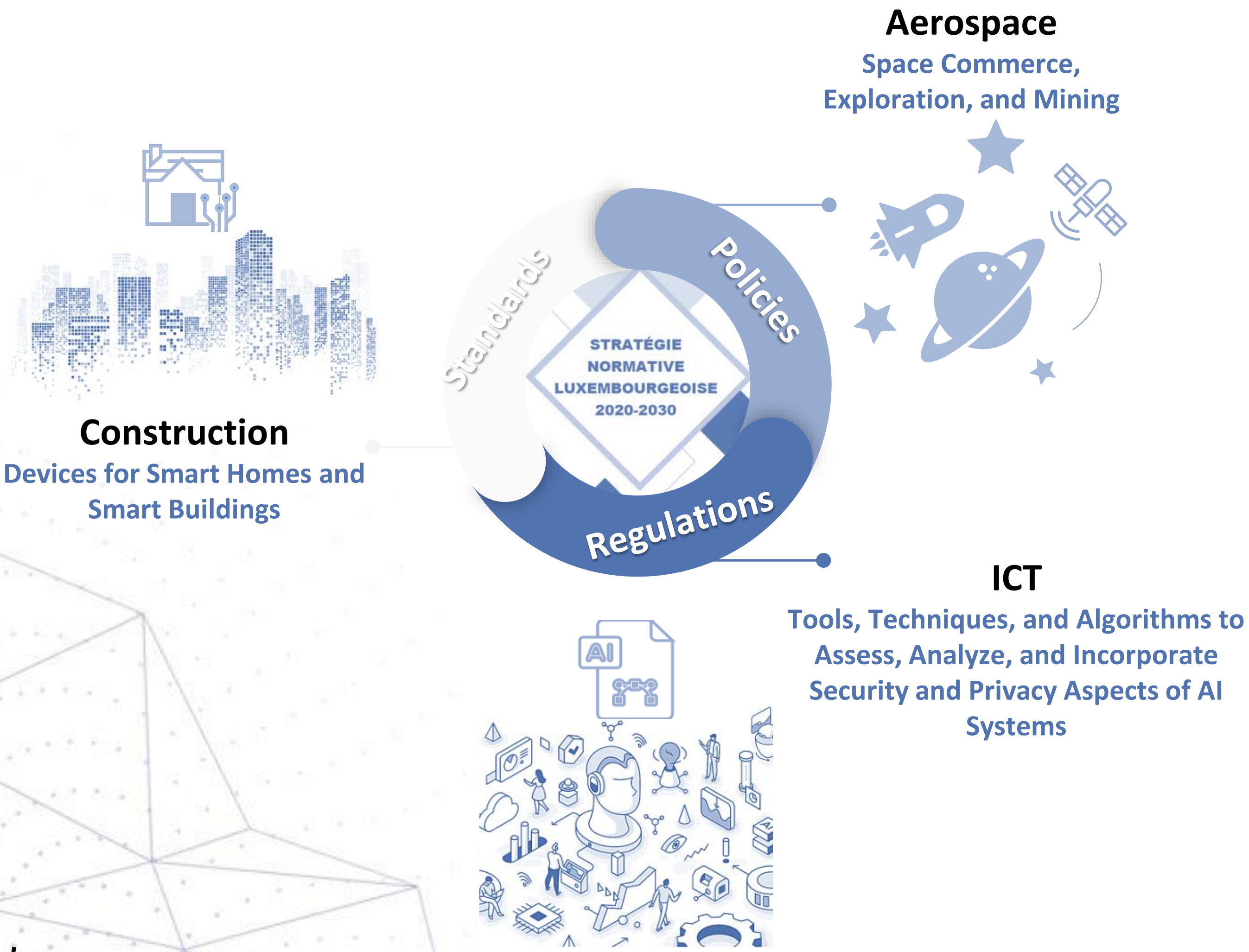
- **Objective**
  - Optimizing the interface and exchange between researchers and technical standardization
- Analyzing **standardization processes**
  - Diffusion, influence, impact
- Aimed **outcomes**
  - Opportunities for researchers (spreading their innovation)
  - Identifying needs for technical standardization (for existing innovations/product/processes)
  - Shorten the gap between research outcome and technical standardization



The Second Research Programme 2021-2024

Technical Standardisation for Trustworthy ICT, Aerospace, and Construction

NATIONAL STANDARDISATION STRATEGY 2020-2030



The UL-SnT Team

Prof. Pascal Bouvry

Principal Investigator
Project coordination
PhD supervision

Dr. Grégoire Danoy

Research Scientist
PhD supervision

Dr. Mohammed Alswaitti

Postdoctoral Researcher
PhD students & Project support

Lena Maria Hartmann
(PhD student)

Supervisor: Dr. Grégoire Danoy
Since 15.02.2022
Aerospace

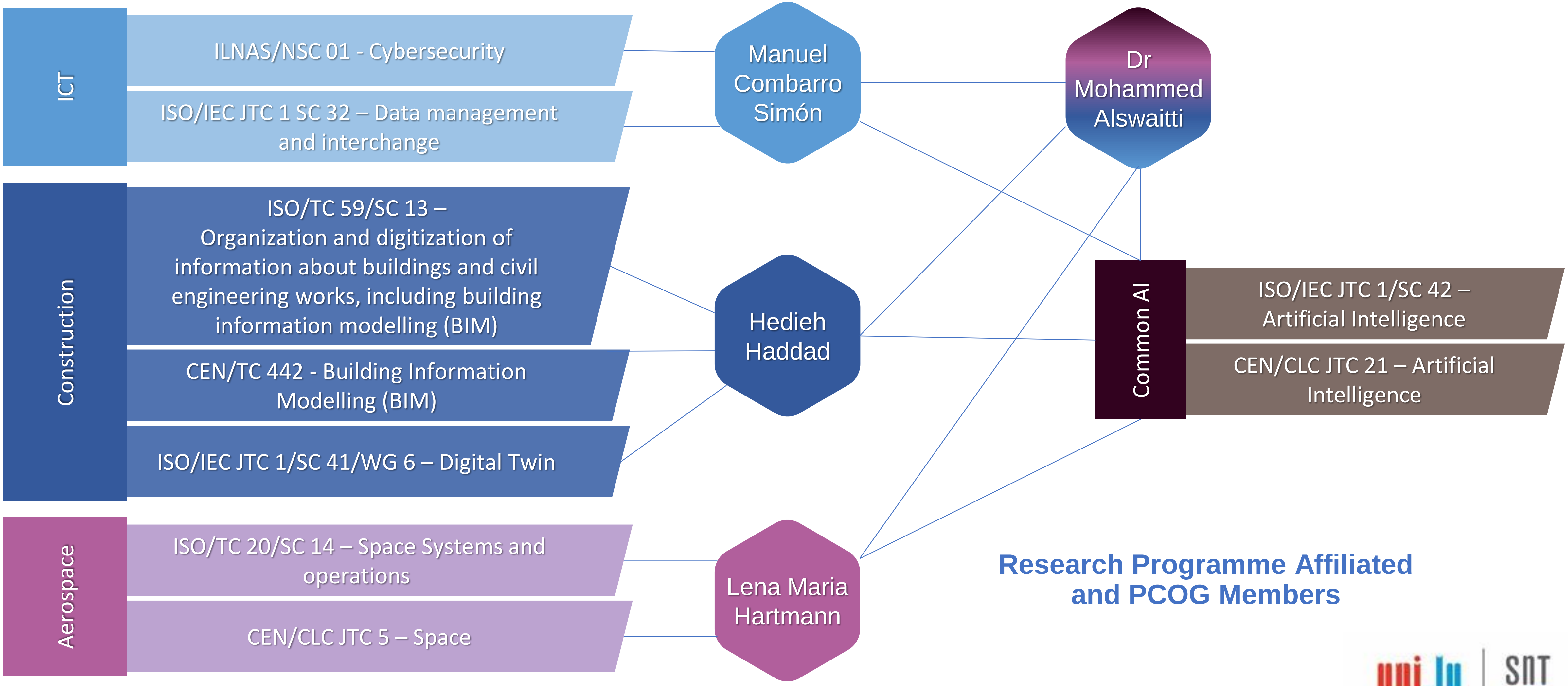
Manuel Combarro Simón

(PhD student)
Supervisor: Prof. Pascal Bouvry
Since 01.11.2021
ICT

Hedieh Haddad
(PhD student)

Supervisor: Prof. Pascal Bouvry
Since 15.01.2022
Construction

Involvement in Standardisation Committees, Work Groups, Advisory Groups



Key figures

5 Wide Audience Talks

1 White Paper

Wide audience Dissemination

5 Conference Articles

Parallel Computing and Optimisation Group

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“ World Standards Day 2023 ” OCTOBER 2023

White Paper - Trustworthiness In ICT, Aerospace, and Construction Applications

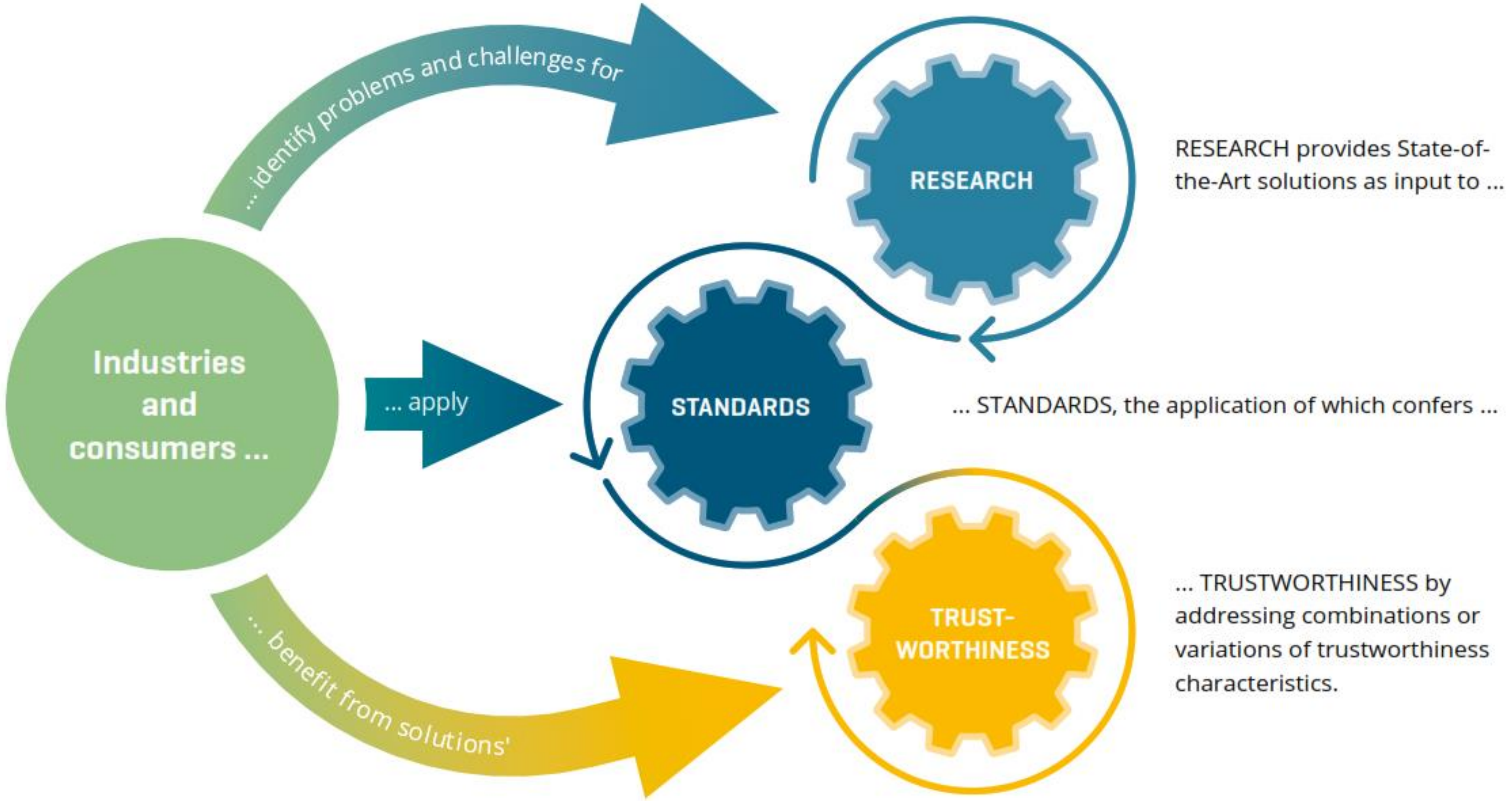
Dr. Mohammed Alswaitti

Postdoctoral Researcher

University of Luxembourg

White Paper Overview

The Link Between Standards and Research



Definitions of Trustworthiness

Common intuition essentially views trust in someone or something as a form of belief, hope, or confidence in being reliable for some purpose.

Merriam-Webster dictionary[1] considers trust as being the "*assured reliance on the character, ability, strength, or truth of someone or something*".

1. https://www.merriam-webster.com/dictionary/trust#dictionary-entry-1

Trustworthiness Characteristics

In ICT more precise definition is needed where the standardization committee ISO/IEC JTC 1 Information Technology[1] dedicated working group of JTC 1 - **WG 13** to investigate these matters.

The technical specification ISO/ IEC TS 5723:2022 **Trustworthiness – Vocabulary[2]**.

"Ability to meet stakeholders' expectations in a way that can be checked for correctness by a person or tool"

Characteristic	Simplified definition
Accountability	State of being answerable for actions, decisions, and performance
Accuracy	Measure of closeness of results of observations, computations, or estimates to the true values or the values accepted as being true
•••	
Integrity (of data and of systems)	For data: property whereby data have not been altered in an unauthorized manner since they were created, transmitted, or stored For systems: property of accuracy and completeness
•••	
Resilience (from a governance point of view and a system point of view)	Governance point of view: ability to anticipate and adapt to, resist, or quickly recover from a potentially disruptive event, whether natural or man-made For systems: capability of a system to maintain its functions and structure in the face of internal and external change, and to degrade gracefully when this is necessary
Robustness	Ability of a system to maintain its level of performance under a variety of circumstances
•••	
Quality (of data and of systems)	For data: degree to which the characteristics of data satisfy stated and implied needs when used under specified conditions For systems: degree to which a set of inherent characteristics of an object fulfils requirements
Reliability (from a cybersecurity point of view and a system point of view)	Cybersecurity point of view: property of consistent intended behaviour and results For systems: ability of an item to perform as required, without failure, for a given time interval, under given conditions
•••	

1. https://www.iso.org/committee/45020.html
2. https://www.iso.org/standard/81608.html

Trustworthiness in Three Use Cases

A Combinatorial Problem in Satellite Mosaic Image Generation

1

Accuracy
Integrity
Robustness
Transparency
Usability

ICT

Building Information Modelling

2

Accuracy
Accountability
Quality
Transparency
Usability

Construction

Nanosatellite Swarms

3

Reliability
Robustness
Resilience
Transparency

Aerospace

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The White Paper Structure

1 TRUSTWORTHINESS, RESEARCH, AND STANDARDIZATION

The Benefits of This Synergy with Technical Definitions of Trustworthiness Form an ICT Perspective.

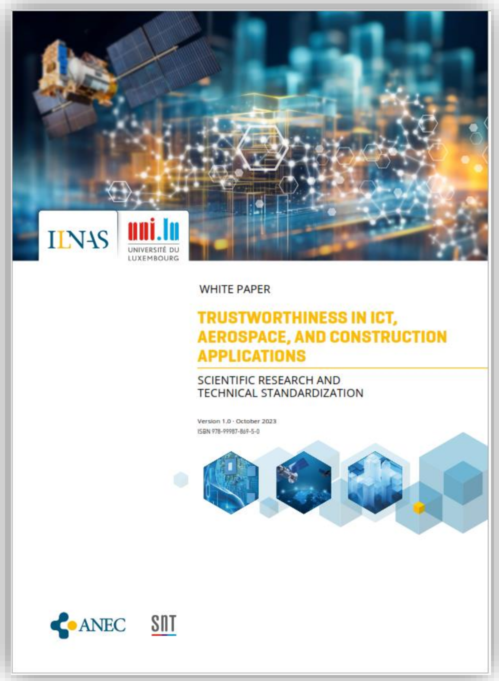
2 TECHNICAL STANDARDIZATION

European Standards Organizations, Relevant Committees to The Research Program, and How To Get Involved.

3 TRUSTWORTHINESS IN ICT-SUPPORTED APPLICATION DOMAINS: USE CASES

- A Combinatorial Problem in Satellite Mosaic Image Generation
- Building Information Modelling
- Nanosatellite Swarms

4 CONCLUSION AND OUTLOOK



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SnT, Interdisciplinary Centre for Security, Reliability and Trust

Trustworthiness in ICT-supported application domains: Use cases

Use Case 1

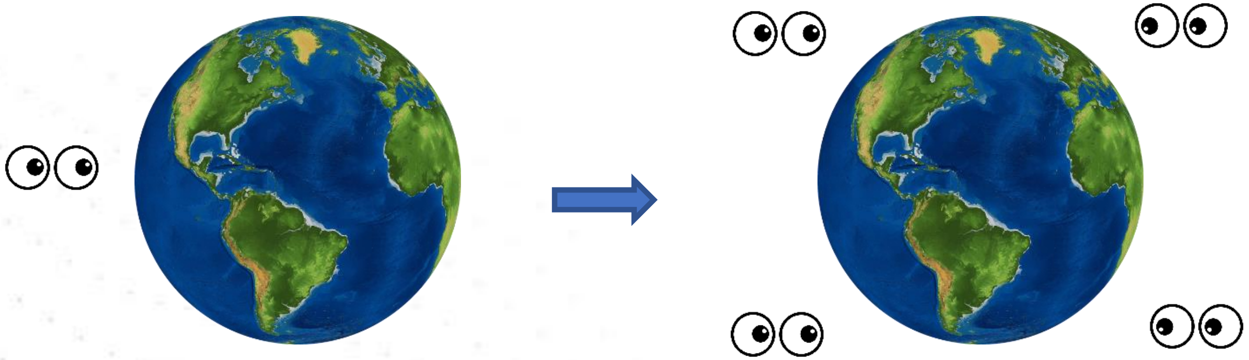
"Combinatorial Optimization for Satellite Image Mosaic Generation"

Manuel Combarro Simón

PhD Student (ILNAS/SnT – ICT)

University of Luxembourg

Motivation: Increase in satellite imagery and applications



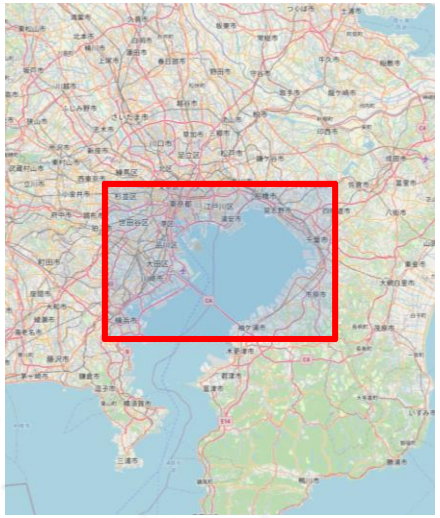
2014
192 EO satellites

2021
971 EO satellites

>100 TB of satellite imagery per **day**

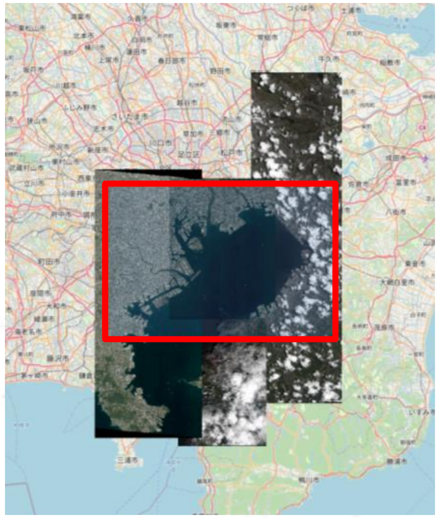
Satellite images: Planet Labs, Inc.

Satellite image mosaic



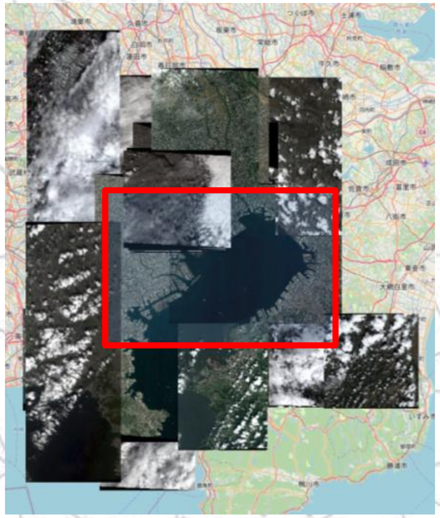
To cover large areas it is necessary to merge several images together

Satellite Image Mosaic Selection Problem (SIMS)



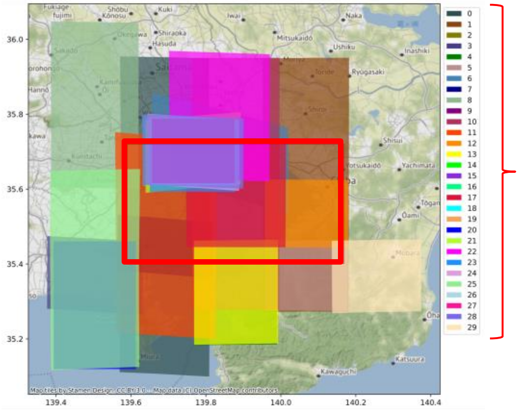
Related state of the art problems for mosaic generation:

- Geometric correction of the images
- Color harmonization
- Image stitching



Combinatorial problem of selecting the images to generate the mosaic

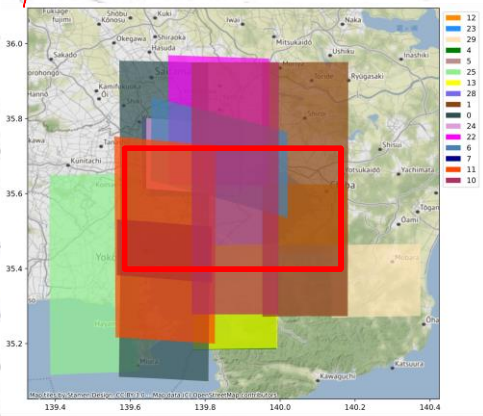
Research problem: Which combination of image is the the best one to make the mosaic

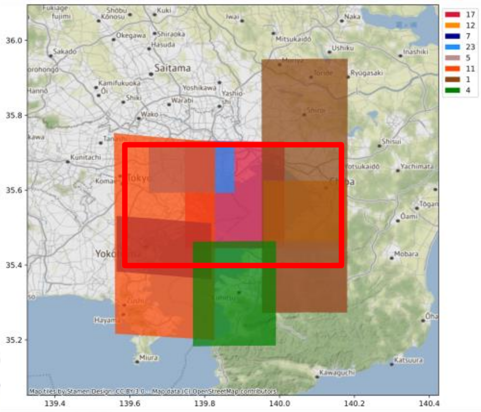


After a query with certain parameters:

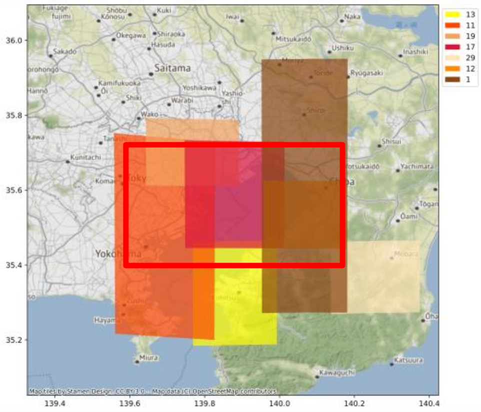
N = 30 satellite images

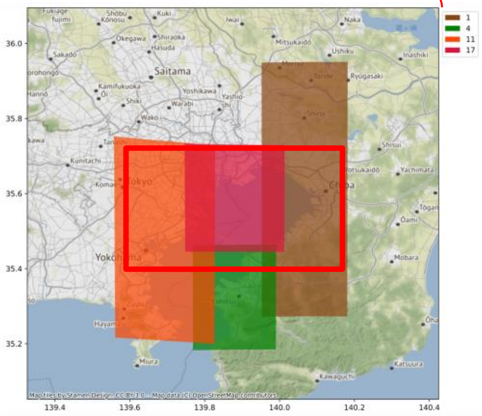
Which combination? 2^N possible combinations. NP-Hard





…

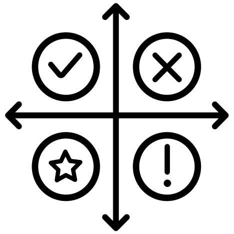


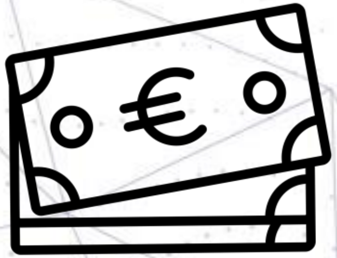


What it means “the best”?

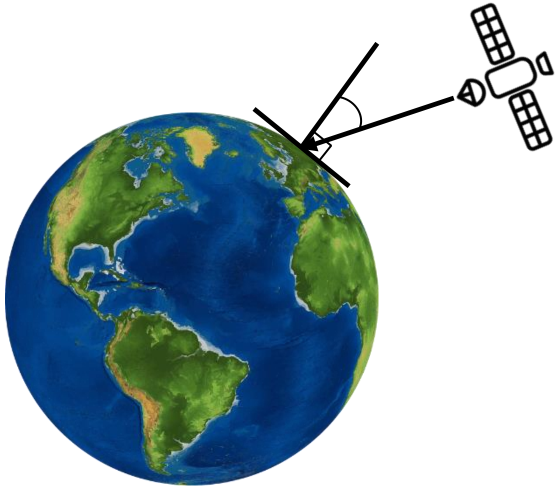
Multi-objective problem:

- Cost
- Cloud coverage
- Resolution
- Incidence angle



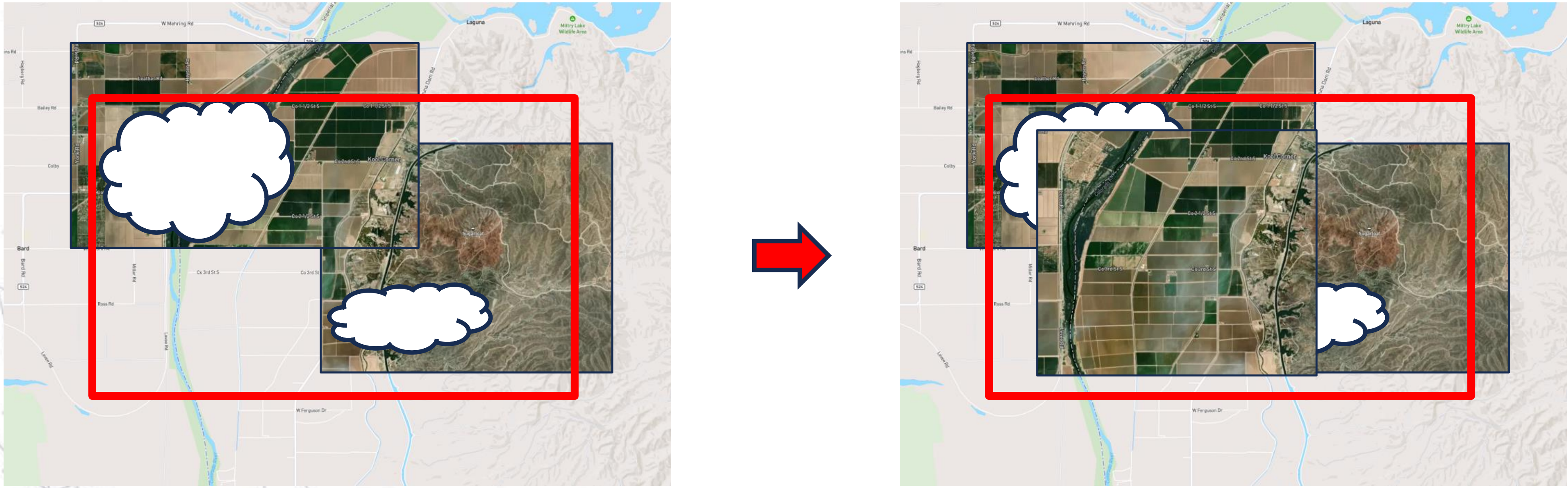


Resolution =
r
$r \times r$ cm^2



Cloud coverage

Possible to reduce the cloud coverage by selecting images that overlap the cloudy areas of other images



Trustworthines considerations – System & Output

Accuracy. Compare the system against similar strategies using a common benchmark. Trust relies on benchmark design, number of tests, strategies used for comparison.

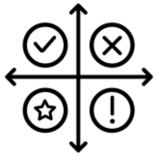
Integrity. Completeness. If a cover of the AOI exists, the system should return at least one solution.

NO

Robustness. Maintain level of performance for different test cases.

Transparency. Display the selected images with their information as well as the total cost

Usability. Possibility of setting which parameter is more important to be optimized

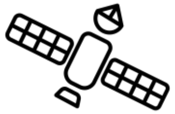


Trustworthines considerations – Input

Accuracy. Image geographic coordinate error, resolution and projection. **Accuracy of output data depends on the accuracy of the input data**

Quality. Correct image information.

Transparency. Images should have information about their provenance (satellite, date).



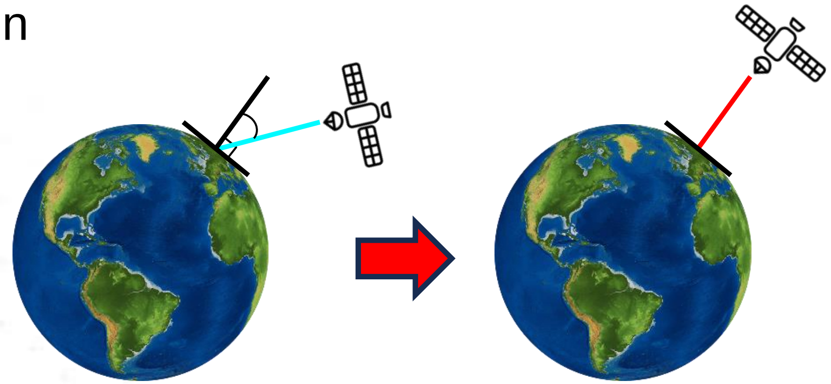
Standardization in support of trustworthiness

Title	Relation to Satellite Image Selection Problem
ISO 19157-1:2023 Geographic information — Data quality — Part 1: General requirements	**Image accuracy & quality**. Allow the satellite provider to **compute positional and temporal errors inherent to its global system** (images acquisition and associated geoposition system)
ISO 19130-1:2018 Geographic information — Imagery sensor models for geopositioning — Part 1: Fundamentals	**Image accuracy**. Coordinate information is vital. This standard is extremely important to guarantee the accuracy of the input data in the SIMS problem, especially from the **geopositioning** aspect. Moreover, as a part of the geopositioning task, **sensor correction methods are described**, by **taking into account all distortion that may occur due to sensor assembly and environmental conditions**.
ISO 19116:2019 Geographic information — Positioning services	**Image accuracy.** This relates to coordinates. This standard provides a description of positioning information which can be shared between different entities. **The information shared via this protocol allows to reach confidence in the satellite position and consequently in the geopositioning information of the resulting images.**
ISO/TS 19159-1:2014 Geographic information — **Calibration and validation** of remote sensing imagery sensors and data — Part 1: Optical sensors	**Image quality**. The **performance of an optical sensor can be compromised** due to several risks during its manufacturing possibly leading to: incorrect focus point, geometrical deformation, incorrect color representation of the acquired image.
ISO/AWI 20550 Space systems — Pointing management for optical Earth observation	**Image quality**. This is more a document in relation with the **satellite's sensors**. Currently under development, this standard will help to improve the quality of the satellite image acquisition.

Preprocessing for Satellite Image Selection Problem

Several pre-processing tasks are needed, such as radiometric correction or grey level stretching but for SIMS this two are the main ones:

- Orthorectification



1

- Cloud detection

0	0	0	0	0	0	0	0
0	0	0	0	1	1	0	0
0	1	1	0	1	1	0	0
0	1	1	0	0	0	0	0
0	0	0	0	0	0	0	0

Chen, Q.; Zhang, Y.; Li, X.; Tao, P. Extracting Rectified Building Footprints from Traditional Orthophotos: A New Workflow. *Sensors* **2022**, *22*, 207. https://doi.org/10.3390/s22010207

Standardization for preprocessing

Title	Relation to Satellite Image Selection Problem
ISO 19130-1:2018 Geographic information — Imagery sensor models for geopositioning — Part 1: Fundamentals	This standard covers the distortion correction related to the optical sensor and environmental distortion but can be extrapolated to orthorectification also. Knowing the change of coordinates system and the definition of model allows to create the link between pixel and geopositioning coordinates and thus remove the distortions related to the incidence angle.
ISO/TS 19159-1:2014 Geographic information — Calibration and validation of remote sensing imagery sensors and data — Part 1: Optical sensors	Annex C of this document presents different self-calibration models which allow geometrical corrections of optical sensor. As the geometrical distortions caused by the acquisition angle can be compared to optical sensor distortions, information presented in this document, in addition of ISO 19130-1, would allow to better accomplish the orthorectification task.
EN 17030:2018 Space – Earth observation – Image processing levels	This standard provides a classification of the different images according to processing steps. It covers pre-processing in general. This classification may support the transparency characteristic through the forwarding of this classification information of mosaic-selected images to the user.

Unfortunately, no standard providing harmonized methods for cloud detection is currently available

Naming convention

Metadata	ISO 19115 name (ISO/TC 211 - Geographic information/Geomatics)	Marketplace	Satellite mission	
		Up42	SkySat	Pléiades
Geographic coordinates	/	geometry	posList	geometry
Date and time of the image	Time	acquisitionDate	acquisitionDate	acquisitionDate
Resolution of the image	groundResolution	resolution	resolution	resolution
Incidence angle	/	In the provider field	incidenceAngle	incidenceAngle
Cloud coverage	cloudCoverPercentage	cloudCoverage	cloudCoverPercentage	cloudCover
Method of cloud cover determination	/	In the provider field	cloudCoverPercentage	/
Sun elevation	illuminationElevationAngle	In the provider field	illuminationElevationAngle	illuminationElevationAngle
Sun position	illuminationAzimuthAngle	In the provider field	illuminationAzimuthAngle	illuminationAzimuthAngle

- SkySat64 -> Application schema defined in the Open Geospatial Consortium (OGC) "*Best Practices document for Optical Earth Observation products version 0.9.3*"
- Pléiades (Airbus) -> Standard introduced for the SPOT 5 launch in 2002, DIMAP66

Use case conclusion

- Efficiently tackling the challenge of providing a satellite image mosaic is not limited to good design and implementation it is necessary to guarantee the trustworthiness aspects of the system, output data and input data.
- Standards play a key role in guaranteeing the image resolution and their correct geographic coordinates.
- Cloud detection is a necessary preprocessing step to fulfill quality criteria but also to satisfy user requirements. Unfortunately, there are no standards providing harmonized methods to do it.
- Currently, different satellite image providers use different standards resulting in different naming conventions, and the efforts of the marketplaces to overcome this issue seem insufficient, as their metadata scheme is too simple and cannot cover all the required fields. To improve this situation, a possible option is to implement, in the marketplace, a more robust metadata scheme following the standards ISO 19115-2 Annex C and ISO 19115-3.

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SnT, Interdisciplinary Centre for Security, Reliability and Trust

Use case 2

"Federated Learning for Swarms of Nano-Satellites"

Maria Hartmann
PhD Student (ILNAS/SnT – Aerospace)
University of Luxembourg

Autonomous satellite swarms are the future

"How swarms of small satellites could revolutionize space exploration" [1]

October 4, 2016

"NASA Works to Give Satellite Swarms a Hive Mind" [2]

Sep 1, 2021

"An **unmanned aerial vehicle** (UAV) **swarm** can be simply defined as a group aerial robotic platform, usually similar in form, coordinating and cooperating to achieve a common goal. Swarms extend robotic capabilities beyond those of a single vehicle through various methods of coordination and cooperation between the different agents." [3]

Source: Eutelsat

[1] How swarms of small satellites could revolutionize space exploration | Stanford University School of Engineering
[2] Giving Satellite Swarms a Hive Mind | NASA
[3] Loianno, G., Weinstein, A., Kumar, V. (2020). Unmanned Aerial Vehicles Swarms. In: Ang, M., Khatib, O., Siciliano, B. (eds) Encyclopedia of Robotics. Springer, Berlin, Heidelberg.

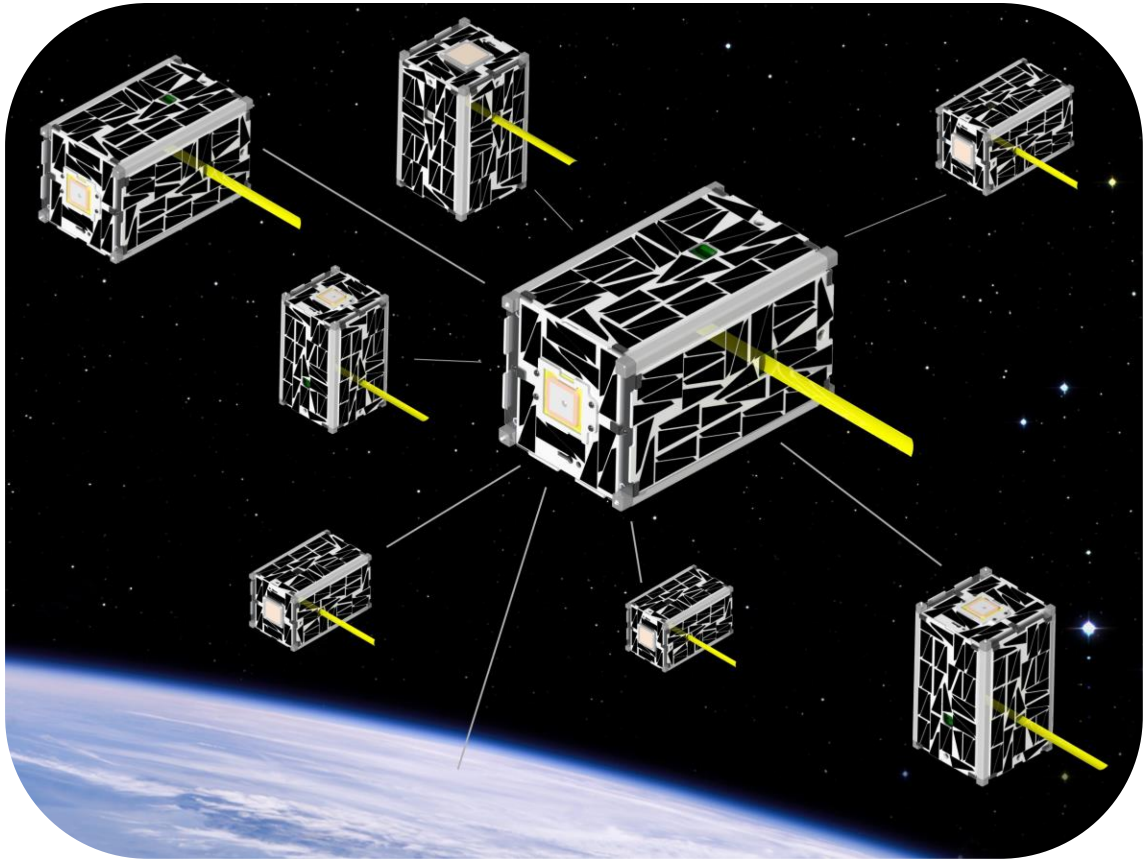
Autonomous satellite swarms have systemic advantages

Flexibility:
- Can manifest collective behaviour beyond individual capability
- Can react to unforeseen circumstances without delay

Scalability:
- Number of satellites may be extended over time

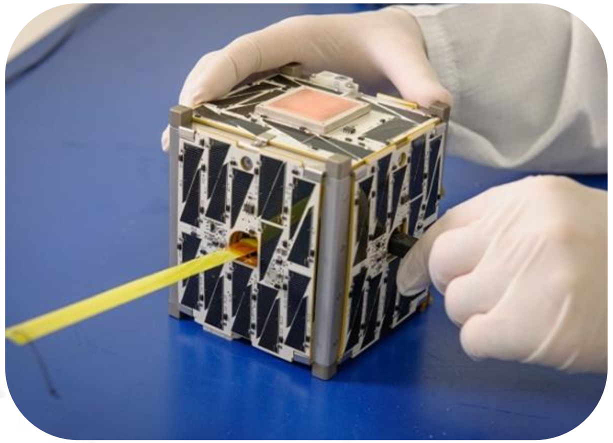
Resilience:
- Can compensate for loss of individual satellites

Cost-effectiveness:
- Can mass-produce standard multi-purpose satellites
- Launching smaller satellites is less expensive



Source: NASA

Autonomous satellite swarms: state of the art



Source: NASA Ames

CubeSats as readily available, low-cost building blocks

- Modular units of 10x10cm

Non-autonomous multi-satellite missions in Earth orbit

- GPS, SWARM, TROPICS, ...

Technology demonstration missions for swarm mobility

- SAMSON, EDSN, Starling-1, …

Source: Technion

Autonomous satellite swarms face challenges

Constraints on computational power
- Nano-satellites' on-board computers have limited capability

Constraints on communication
- Communication requires power, bandwidth and is susceptible to noise

Long Earth-Satellite transmission latency
- Transmission time is proportional to distance

Federated Learning can overcome challenges

Constraints on computational power

- Computational load is shared between satellites

Constraints on communication

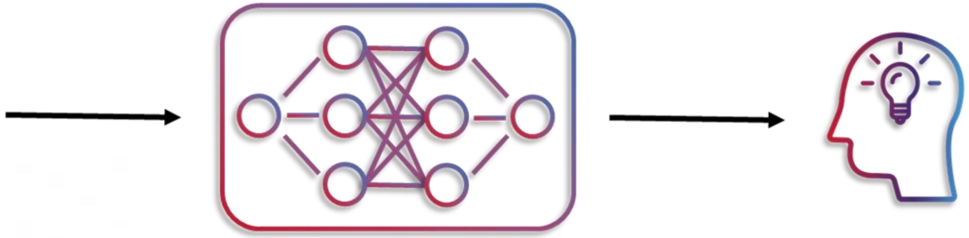
- Satellites transmit less data

Long Earth-Satellite transmission latency

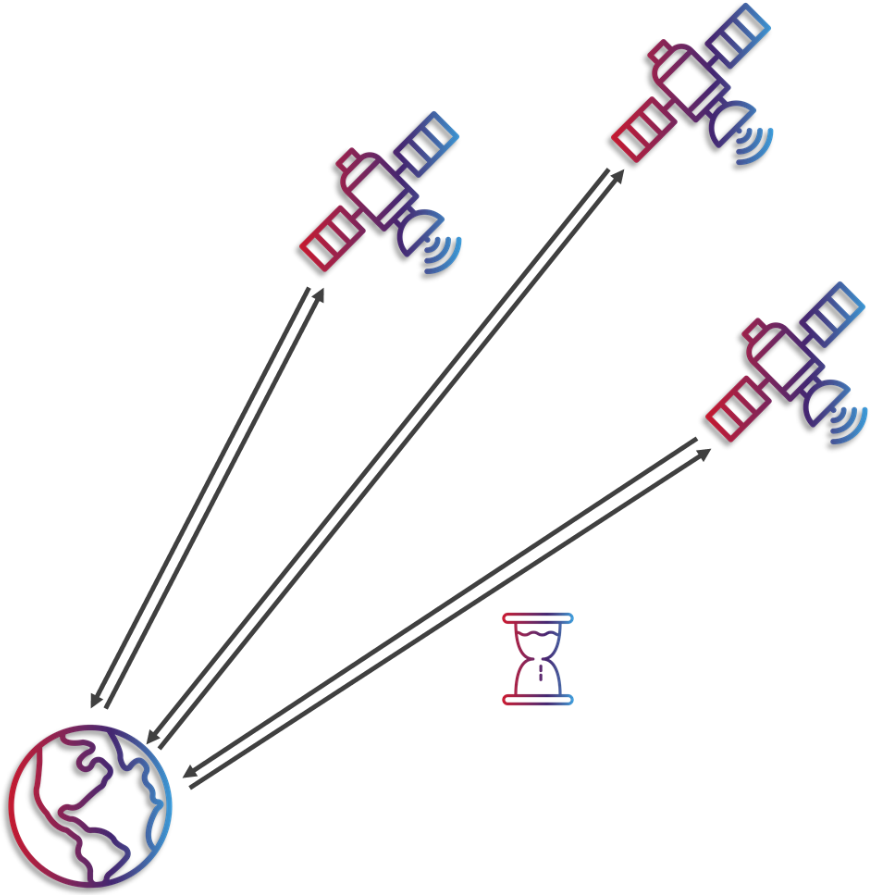
- Learning is not dependent on a connection to earth

How would classical machine learning work?

Source: Anatomies of Intelligence

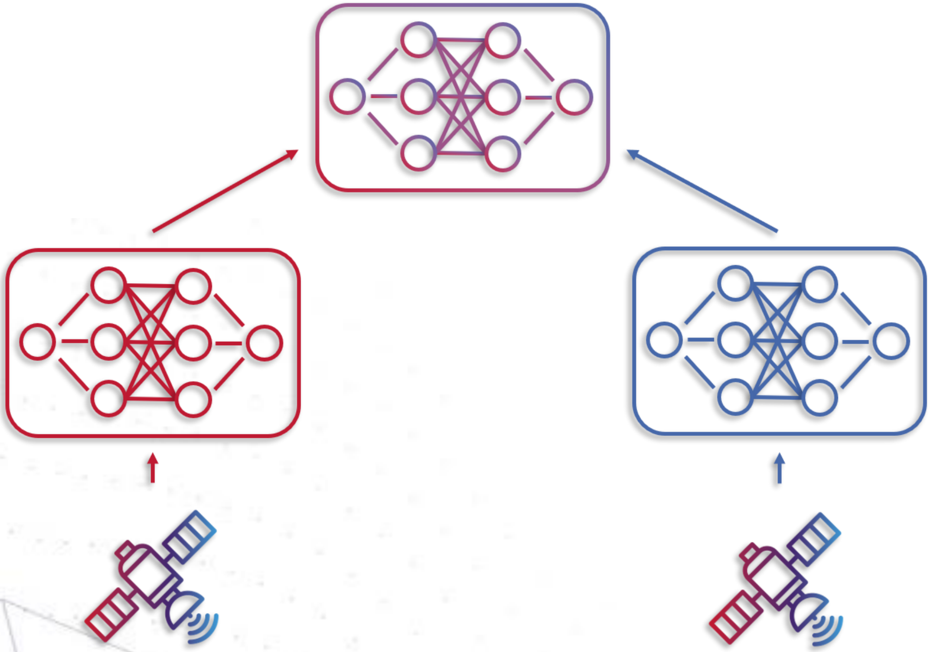


One dataset – one model

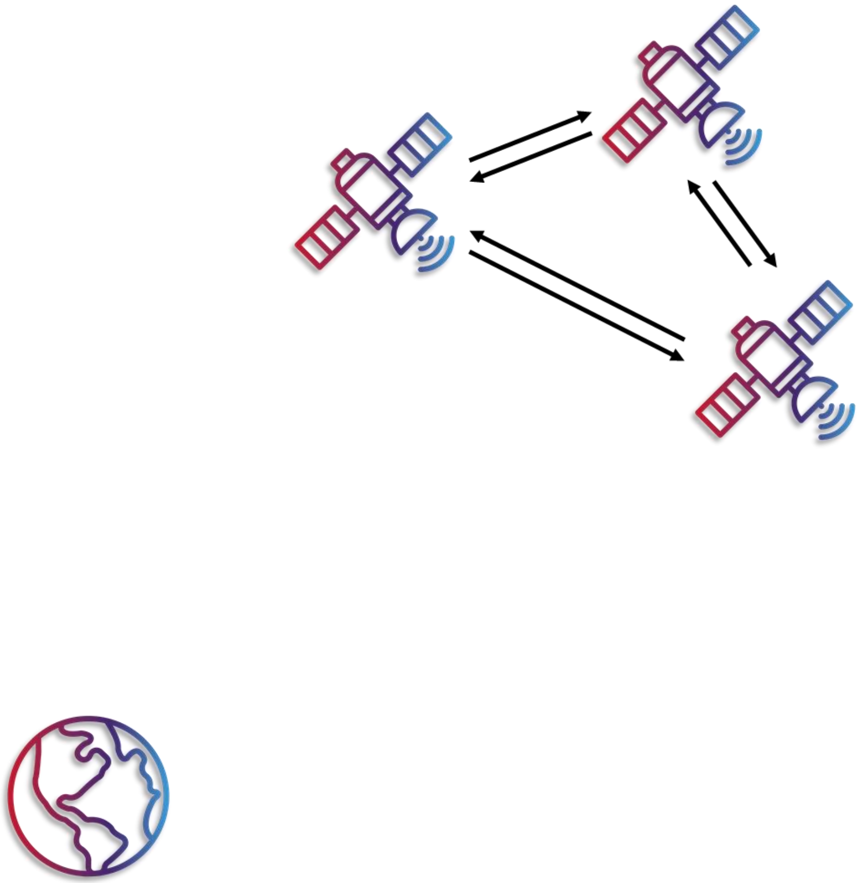


Data aggregation via Earth

How does Federated Learning work?



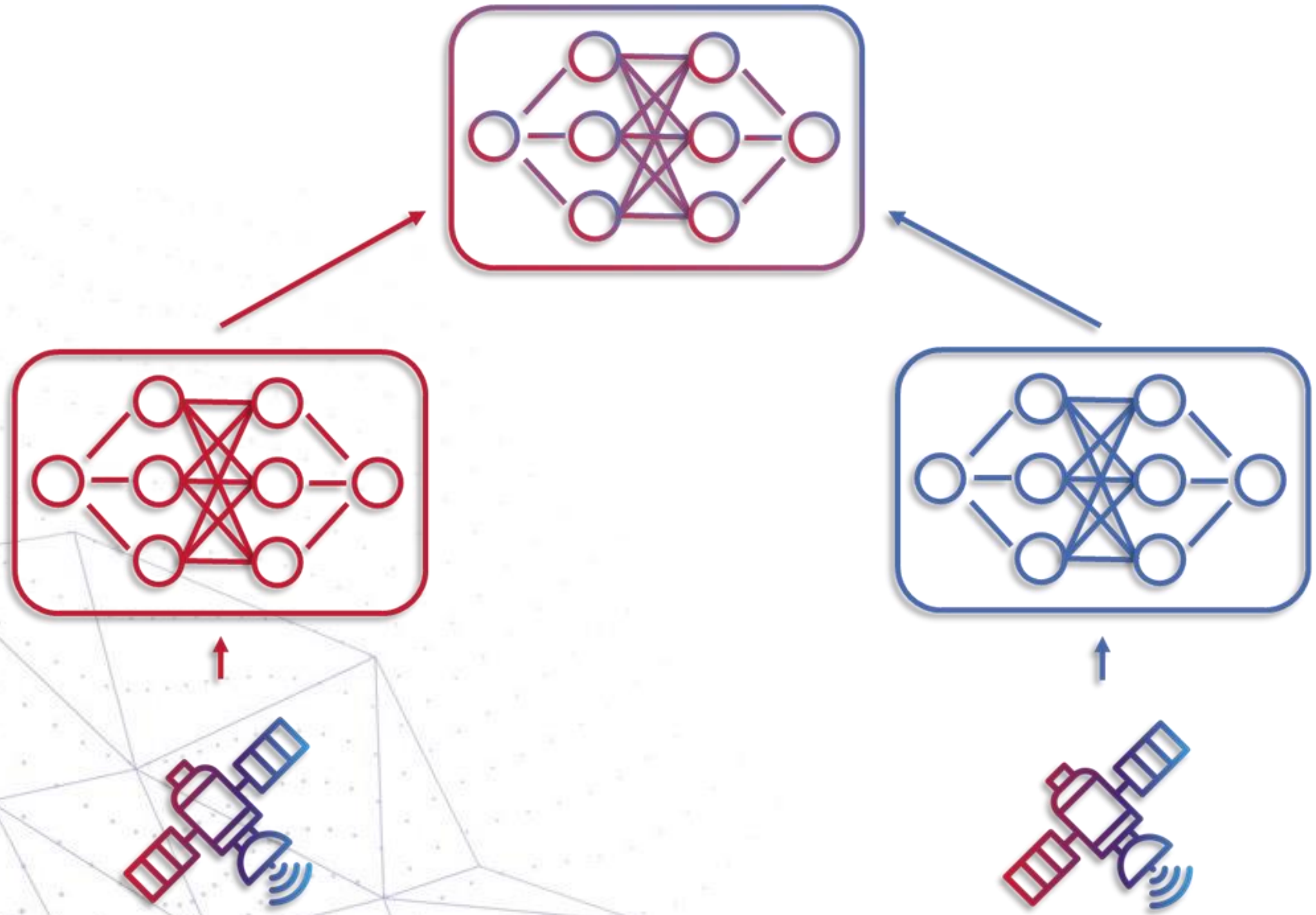
Sharing models, not data



Inter-satellite communication only

How does Federated Learning work?

Sharing models, not data



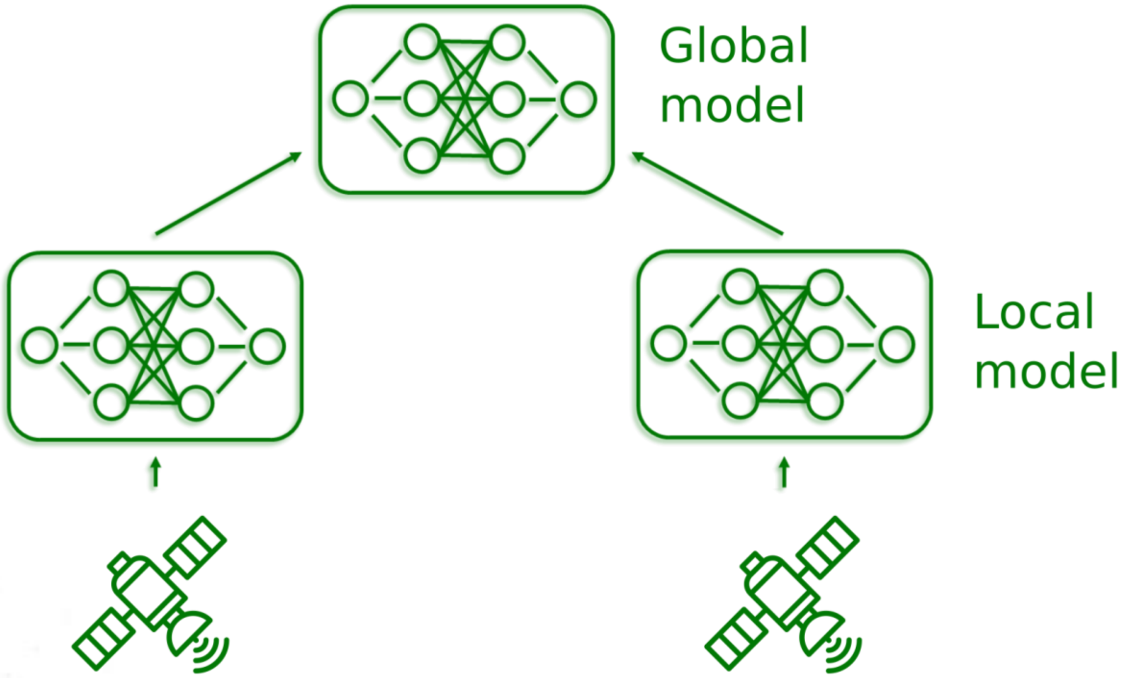
Global Aggregation
One joint model

Local Machine Learning
One model on each satellite

Homogeneous Satellites
Same sensors, different data

Trustworthiness considerations

Reliability. Execute operations the system has been designed for, under given conditions, without any failure. (Run local operations and to contribute to the joint machine learning model).

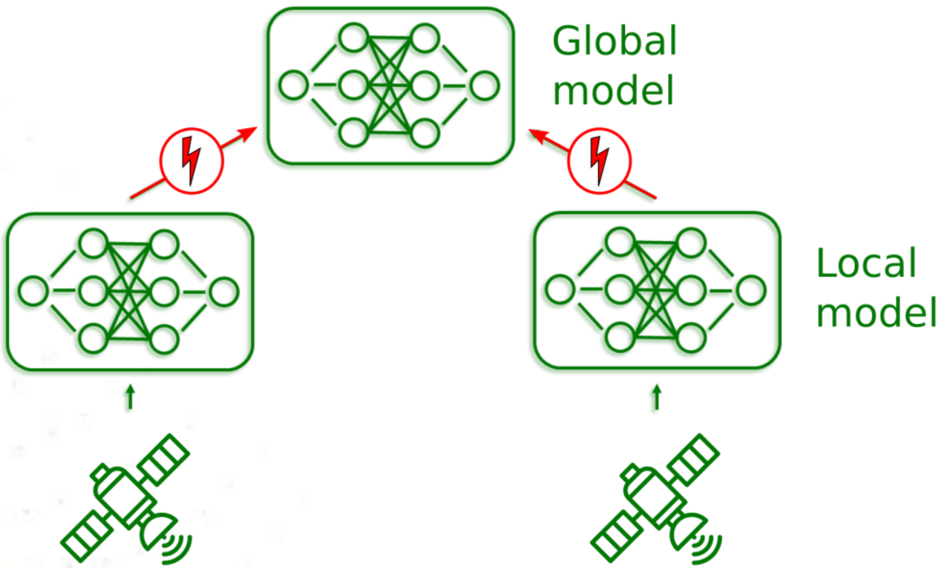


All systems functioning normally.

Trustworthiness considerations

Reliability. Execute operations the system has been designed for, under given conditions, without any failure. (Run local operations and to contribute to the joint machine learning model).

Robustness. Handle the loss and recovery of communications between satellites and with ground control; individual satellites should be able to still perform reasonably even if not currently linked to each other or a server.



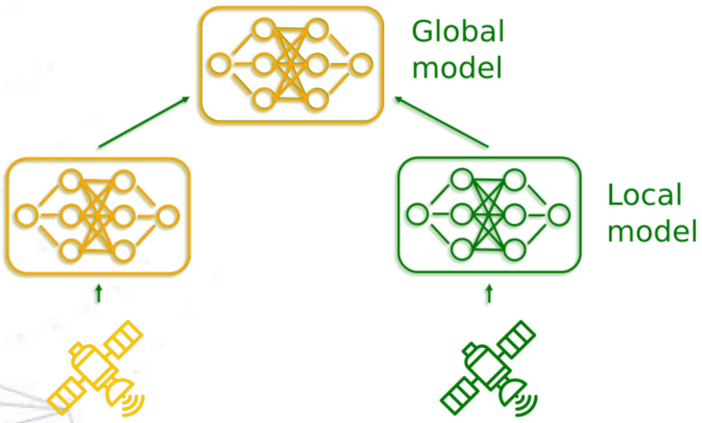
Communication interrupted, local systems functioning normally.

Trustworthiness considerations

Reliability. Execute operations the system has been designed for, under given conditions, without any failure. (Run local operations and to contribute to the joint machine learning model).

Robustness. Handle the loss and recovery of communications between satellites and with ground control; individual satellites should be able to still perform reasonably even if not currently linked to each other or a server.

Resilience. Any machine learning model deployed on individual satellites should be able to compensate for a sudden influx of new and potentially outdated information.



Models impacted by a new participant.

Trustworthiness considerations

Reliability. Execute operations the system has been designed for, under given conditions, without any failure. (Run local operations and to contribute to the joint machine learning model).

Robustness. Handle the loss and recovery of communications between satellites and with ground control; individual satellites should be able to still perform reasonably even if not currently linked to each other or a server.

Resilience. Any machine learning model deployed on individual satellites should be able to compensate for a sudden influx of new and potentially outdated information.

Transparency. The system should record and transmit data that allows for analysis of the machine learning process and decision-making.

Standardisation landscape

Title	Standardisation Committee	Trustworthiness Characteristics
ISO/IEC CD TS 8200 Information technology — Artificial intelligence — Controllability of automated artificial intelligence systems	ISO/IEC JTC 1/SC 42 Artificial intelligence	Transparency, Robustness
ISO/IEC TS 4213:2022 Information technology — Artificial intelligence — Assessment of machine learning Classification performance	ISO/IEC JTC 1/SC 42 Artificial intelligence	Transparency, Robustness
ISO/IEC AWI TS 17847 Information technology — Artificial intelligence — Verification and validation analysis of AI systems	ISO/IEC JTC 1/SC 42 Artificial intelligence	Resilience, Robustness, Reliability
ISO/IEC TR 24029-1:2021 Artificial Intelligence (AI) — Assessment of the robustness of neural networks — Part 1: Overview	ISO/IEC JTC 1/SC 42 Artificial intelligence	Robustness
ISO/IEC 23894:2023 Information technology — Artificial intelligence — Guidance on risk management	ISO/IEC JTC 1/SC 42 Artificial intelligence	Resilience, Robustness
ISO/IEC TR 29119-11:2020 ISO/IEC JTC 1/SC 42 Artificial intelligence Software and systems engineering — Software testing — Part 11: Guidelines on the testing of AI-based systems	ISO/IEC JTC 1/SC 42 Artificial intelligence	Transparency, Robustness, Reliability
ISO/IEC TR 24028:2020 Information technology — Artificial intelligence — Overview of trustworthiness in artificial intelligence	ISO/IEC JTC 1/SC 42 Artificial intelligence	Robustness, Resilience, Transparency
CEN/CLC/TR 17603-40-02 Space engineering - Machine Learning Qualification for Space Applications Handbook	CEN/CLC/JTC 5 Space	Transparency, Robustness, Reliability
ISO/IEC 4922-1:2023 Information security — Secure multiparty computation — Part 1: General	ISO/IEC JTC 1/SC 27 Information security, cybersecurity and privacy protection	Robustness

Use case conclusion

AI is a rapidly developing field, so

Standardisation is of high importance to raise confidence and trust for stakeholders, BUT
Standardisation is challenging.

Little existing standardisation for the application of artificial intelligence to the aerospace use case, mainly high-level guidelines.

Developing general standardisation may be difficult at this stage, but well-targeted specific standards remain feasible.

Parallel Computing and Optimisation Group

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SnT

ILNAS

Use Case 3

“Advanced Building Information Modelling”

Hedieh Haddad

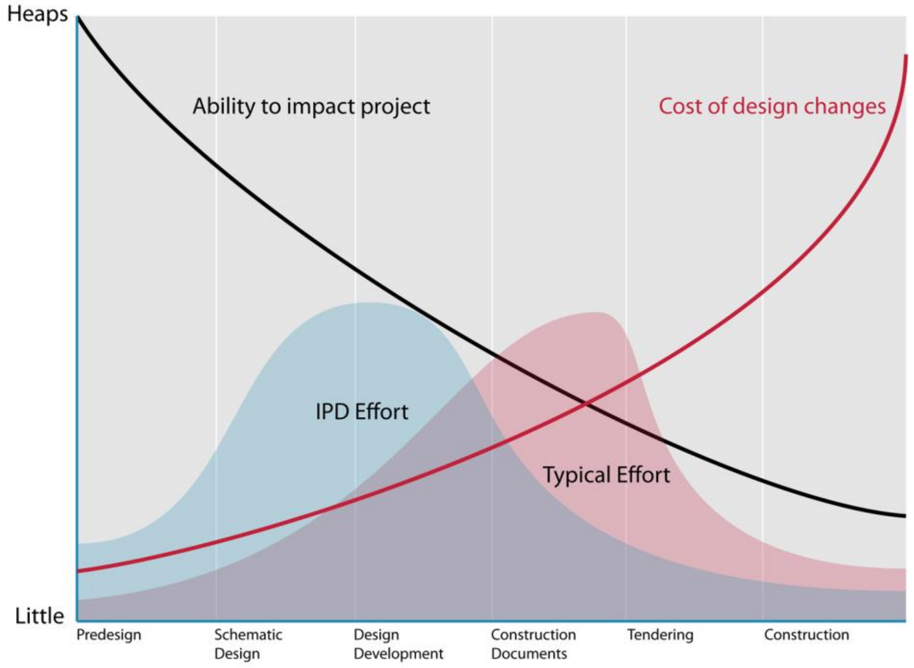
PhD Student (ILNAS/SnT – Construction)

University of Luxembourg

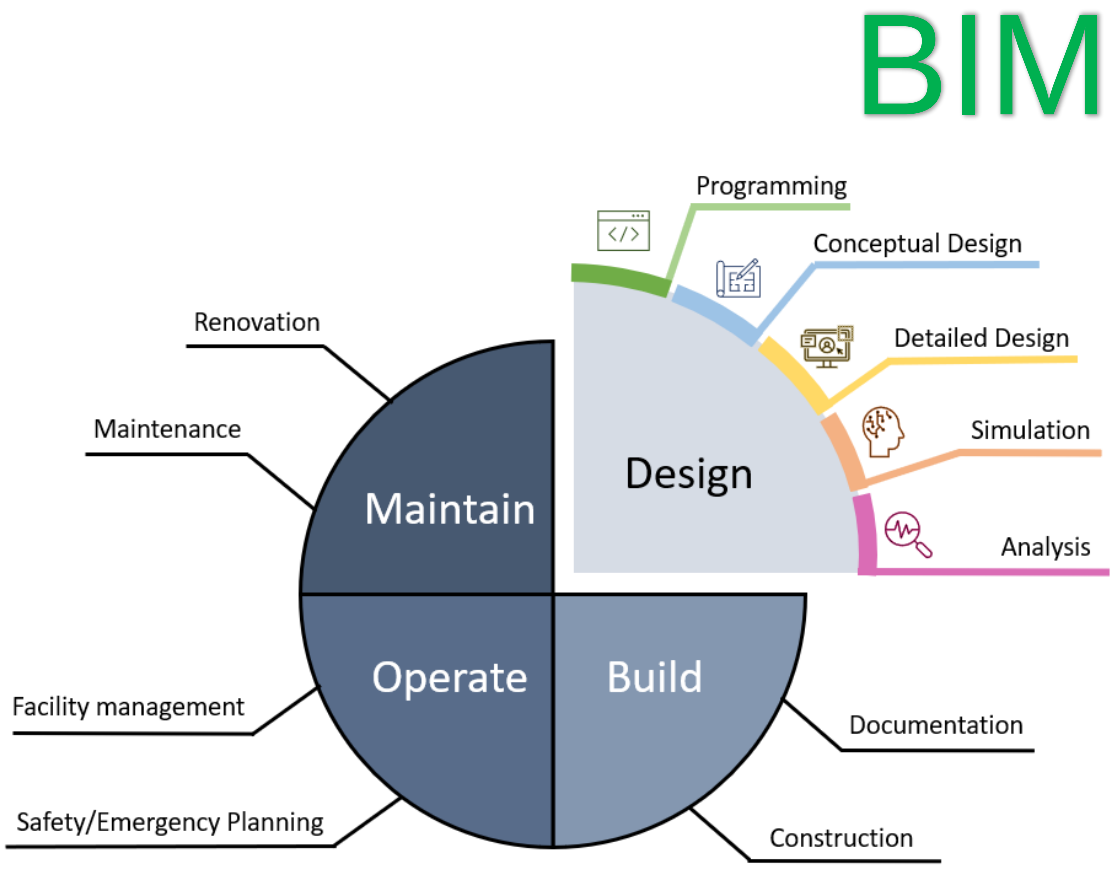
UNIVERSITY OF LUXEMBOURG

Construction Project Management

- Mac-Leamy curve
- Define and plan the project in the design phase



MacLeamy curve (2004)



Research question

The most important problems in Architecture, Engineering and Construction (AEC) industry:

1. Energy-inefficiency
2. Budget overrun
3. Time overrun
4. Eco-unfriendliness
5. Lack of transparency and clarity in workflow

How can combinatorial optimisation help to reduce building construction costs while also achieving a well-designed, energy-efficient building throughout its life cycle?

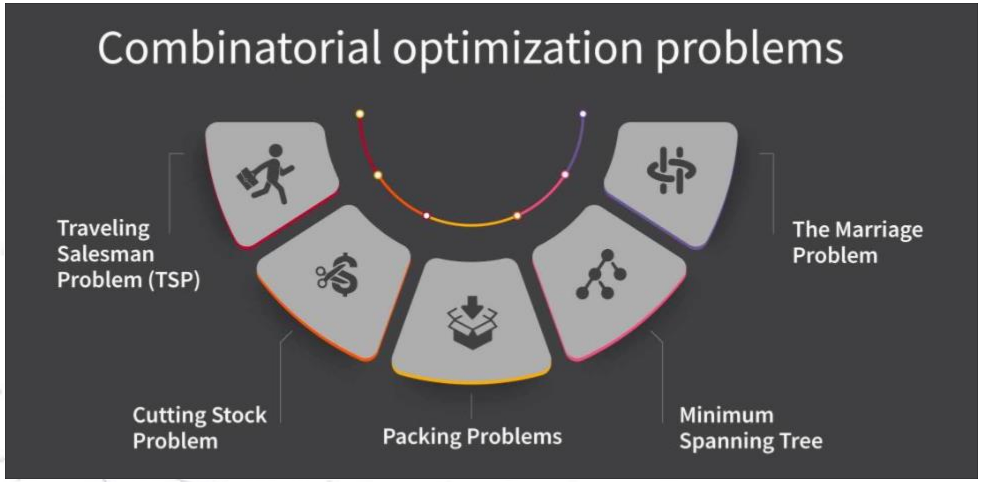
Research problem

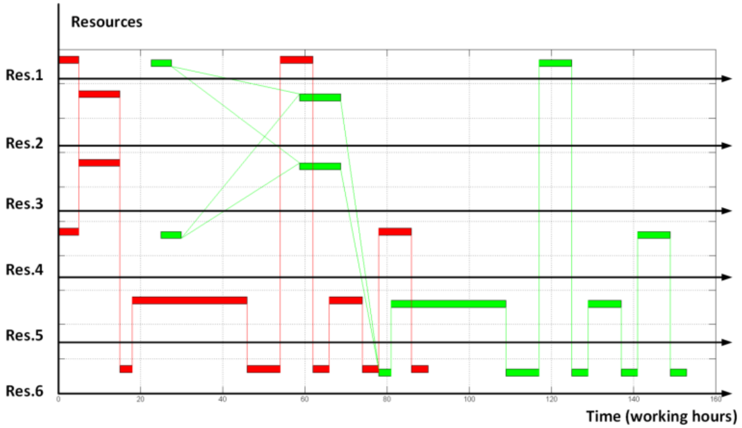
Optimise the following goals (objectives):

1. Minimize Cost
2. Minimize Energy Use Intensity (heat gained or lost through doors and windows)
3. Well-designed -> Maximize Useful Daylight Illuminance (UDI)

Conflicting objectives!

Approach: Combinatorial Optimization





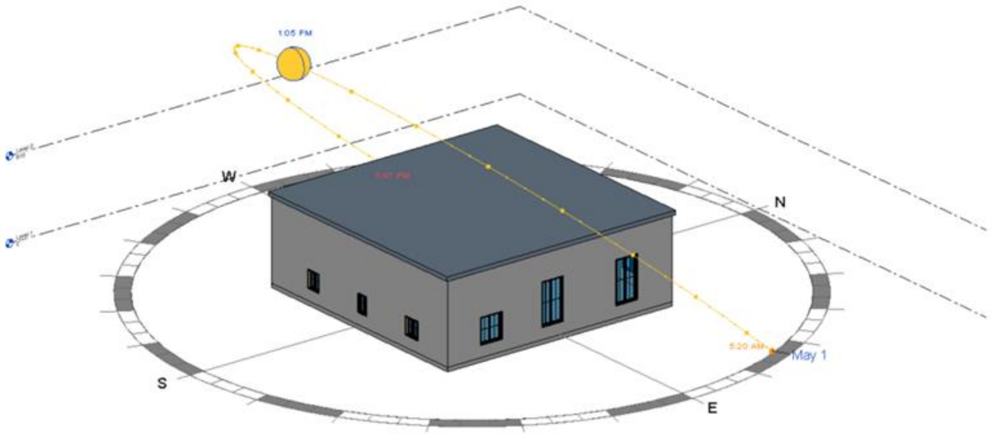
Combinatorial optimization | Engati
Combinatorial optimization - Wikipedia

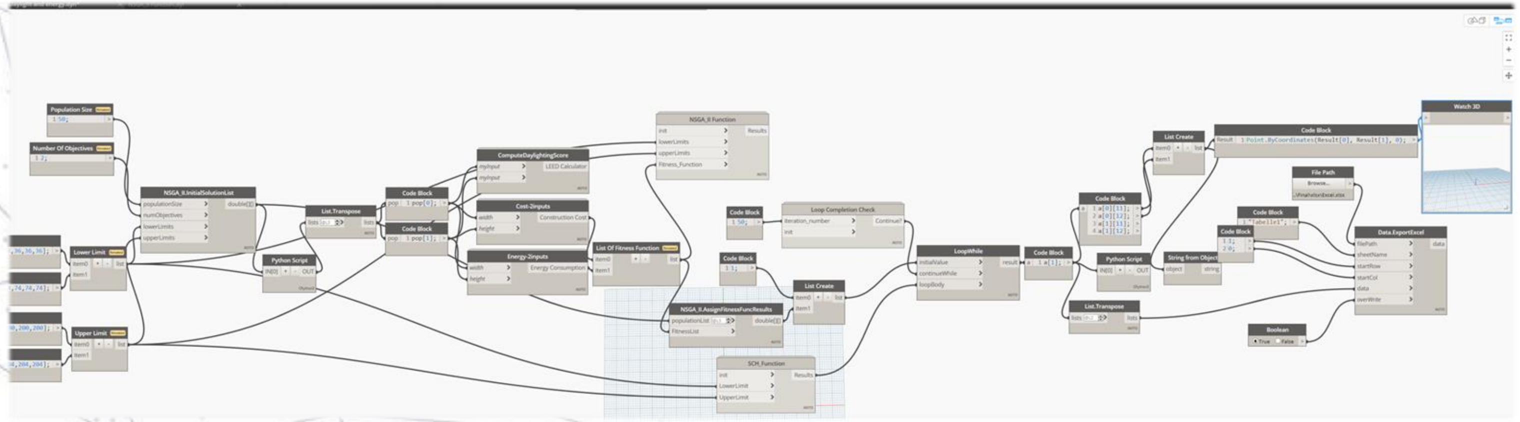
Optimization Model

Variable name		Lower limit	Upper limit	Units	Numeric type	Constraint
Orientation		North, South, East, West, North-East, North-West, South-East, South-West		Degree	Discrete	
Window Type	Window Height	Type 1, Type 2, Type 3		cm	Continuous	$73.66 < W_h < 203.2$
	Window Width			cm	Continuous	$35.56 < W_w < 104.14$
Number of Windows		1 per room	*		Discrete	$1 < N_w$
Window-to-wall ratio		**	80% of wall area	%	Continuous	$R_{ww} < 0.8$
Daylight Illuminance		100	2000	lux	Continuous	$100 < DI < 2000$
Window distance from floor and ceiling		80 from floor	45.72 from ceiling	cm	Continuous	$80 < D_{WF}$ & $45.72 < D_{WC}$
Window distance from doors		30	--	cm	Continuous	$30 < D_{WD}$

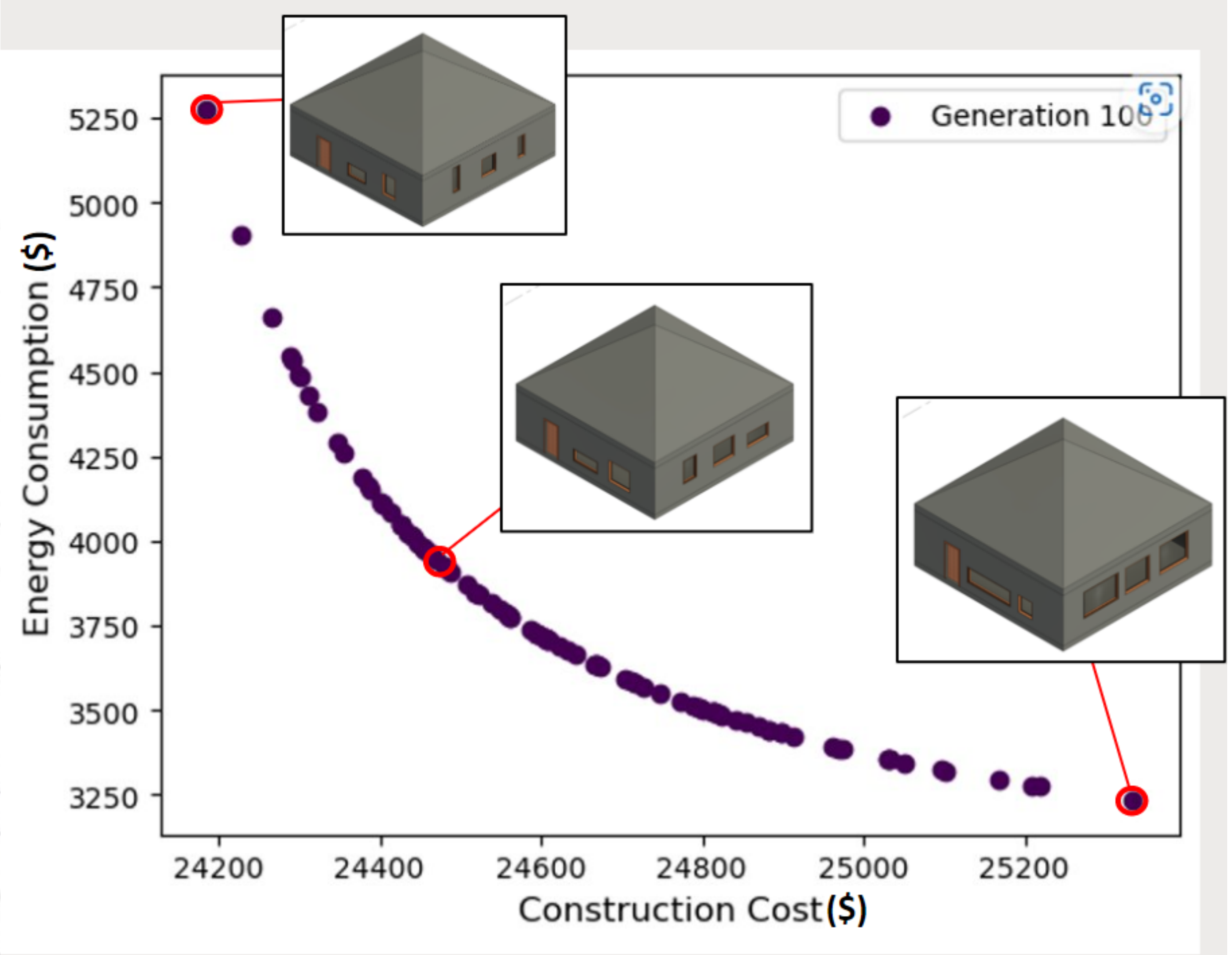
Model development & experimentation

- Autodesk Revit
  - Dynamo





Results: A set of configurations (Pareto front)



Each point in the solution is a configuration representing a different trade-off between objectives

Trustworthiness considerations in BIM

- Accuracy
- Accountability
- Quality
- Transparency
- Usability

Standardisation landscape

Input data | *Optimisation via BIM* | *Output data*

ISO 16739-1 – Provides definition of information exchanged and shared between BIM contributors during the different steps of building life-cycle

Input data

EN ISO 23386
Message format definition in order to reach easy interroperability between different project contributors

ISO 10916:2014
Provides method for energy calculation based on daylight

ISO/IEC 10077-1:2017
Thermal performance of windows, doors and shutters

Optimisation via BIM

EN ISO 19650 series
Concept and principles for information management of BIM

ISO/IEC 33063:2015
Software testing

ISO/IEC 25000:2014
Software quality managment

Output data

EN ISO 23386
Message format definition in order to reach easy interroperability between different project contributors

ISO 52000-1:2017
Provides framework for energy prediction

ISO/IEC 20086:2019
Provides method for energy calculation based on daylight

ISO 15469:2004
Provides method for energy calculation based on daylight

Standardisation landscape

- Input data
- Optimisation via BIM
- Output data

Relevance	Title	Standardisation Committee	Trustworthiness Characteristic
Input data	**ISO 19650-1:2018** Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 1: Concepts and principles	ISO/TC 59/SC 13 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)	Quality, Accuracy
	ISO 23386:2020 Building information modelling and other digital processes used in construction — Methodology to describe, author and maintain properties in interconnected data dictionaries	ISO/TC 59/SC 13 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)	Quality, Usability, Transparency
	ISO 16739-1:2018 Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries — Part 1: Data schema	ISO/TC 59/SC 13 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)	Quality, Usability, Transparency
	ISO 10916:2014 Calculation of the impact of daylight utilization on the net and final energy demand for lighting	ISO/TC 274 Light and lighting	Accuracy
	ISO 10077-1:2017 Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 1: General	ISO/TC 163/SC 2 Calculation methods	Accuracy

Standardisation landscape

Relevance	Title	Standardisation Committee	Trusthworthiness Characteristic
BIM optimisation	**ISO/IEC 33063:2015** Information technology — Process assessment — Process assessment model for software testing	ISO/IEC JTC 1/SC 7 Software and systems engineering	Accuracy, Quality
	ISO/IEC 25000:2014 Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE	ISO/IEC JTC 1/SC 7 Software and systems engineering	Accuracy, Quality
Output data	**ISO 52000-1:2017** Energy performance of buildings — Overarching EPB assessment — Part 1: General framework and procedures	ISO/TC 163 Thermal performance and energy use in the built environment	Reliability, Accuracy, Accountability
	ISO/CIE 20086:2019 Light and lighting — Energy performance of lighting in buildings	ISO/TC 274 Light and lighting	Reliability, Accuracy, Accountability
	ISO 15469:2004 Spatial distribution of daylight — CIE standard general sky	CIE International Commission on Illumination	Accuracy

Use case conclusion

- Construction standards provide a reliable foundation for the input data used in BIM systems, ensuring
  - Consistency of results
  - Compatibility of software solutions
  - Reliability of data

- Standards allow for integration of real-world data, enhancing simulations

Standardisation helps establish trust and confidence in the reliability and accuracy of BIM data, allowing the industry to adopt effective decision-making throughout the construction process.

Parallel Computing and Optimisation Group

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Connect with us @SnT_uni_lu SnT, Interdisciplinary Centre for Security, Reliability and Trust

ILNAS

Remise du trophée « Délégué National en Normalisation 2023 »

IEC ISO ITU

Lauréat 2023

Quelques indices…

Diplôme
d’Ingénieur Civil
des Constructions
-
Université de
Liège (Ulg)

Membre de :

Ordre des Architectes et des
Ingénieurs-Conseils

Association Ingénieurs et
Scientifiques
du Luxembourg a.s.b.l.

Stahlinstitut VDEh (D)

Association pour la promotion de
l’enseignement de la construction
acier APK (F)

Employé chez Astron
Buildings
-
Fabricant de
bâtiments industriels

ILNAS
-
Délégué national

Vacataire Uni.lu
-
Collaborateur à
l’Université de Liège
(Ulg)

Lauréat 2023

Quelques indices…

Depuis 1992, il est employé chez ASTRON BUILDINGS S.A. à Diekirch, où il a occupé différents postes :

- Ingénieur bureau d'études et R&D ;
- Gérant du bureau ASTRON à Leipzig (D) (vente, ingénierie) ;
- Chef du bureau d'études (calculs, traitement de commandes tous pays) ;
- Quality Manager (ISO 9001, Réclamations, QA/QC) ;
- R&D Director ;
- Innovation and Methods Manager.

Son coeur de métier est axé sur la recherche dans le domaine des bâtiments industriels en acier et il travaille notamment sur les sujets suivants : méthodes de calcul structurel, nouveaux produits, modélisations énergétiques, bâtiments à zéro énergie NZEB, économie circulaire (parkings démontables), etc.

Il collabore avec des partenaires sur les projets suivants : (AiF) (D) : DASt 2022-2-6 et IGF 19439 N / Research Fund for Coal and Steel (RFCS) (EU) : REDUCE, FIDESC4/ Deutsches Institut für Bautechnik (DIBt): ETA-18/1027.

Il est membre du Cleantech Cluster chez Luxinnovation et du Groupe de travail pour l'économie circulaire du Haut Comité de l'Industrie.

IEC ISO ITU

Lauréat 2023

Quelques indices…

Conférencier à l'Université de Liège et du Luxembourg, il partage son savoir-faire avec les étudiants dans le domaine de la conception et le dimensionnement de constructions légères en acier pour bâtiments industriels.

Aujourd'hui, il apporte son expertise dans :

- le comité technique ISO/TC 323 - Circular economy et dans les WG3 - Measuring and assessing circularity et WG5 - Product circularity data sheet (série ISO 59000). Il a notamment participé activement au groupe de travail du MECO pour l'élaboration du PCDS de base.
- le comité technique CEN/TC 250/SC 1 - Eurocode 1 - Actions on structures (EN 1991) ;
- le comité technique CEN/TC 250/SC 3/WG 8 - Structural Eurocodes ; Eurocode 3 - Design of steel structures ; Evolution of EN 1993-1-8 - Joints and connections ;
- le comité technique CEN/TC 135/WG 2 - Technical requirements for the execution of steel structures et WG 14 - Execution of aluminium structures and steel structures with cold formed structural sheeting (EN 1090 - Execution of steel structures). Il est le président du comité miroir luxembourgeois ;
- le comité technique CEN/TC 350/SC 1 - Sustainability of construction works; Circular Economy in the Construction Sector (EN 17680 Sustainability of construction works) ;
- les comités techniques ECCS/TC 8 - Stability et ECCS/TC 10 - Connections.

Lauréat 2023

Innovation
and Methods Manager

ASTRON BUILDINGS

Félicitations !

Merci à tous les experts impliqués dans la normalisation technique.