Vilnius University

Leveraging Artificial Intelligence for Innovation in Peat Production

dr. assoc. prof. Valentas Gružauskas

dr. Assoc. prof. Valentas Gružauskas

Vilnius University

Education:

- Bachelor of Mathematics & Economics, Master of Industrial Engineering, PhD of Management.

Research & Scientific:

- Teaching “Deep learning”, “Ethical AI for social good” at VU Mathematics and informatics faculty
- Scientific projects related to remote sensing, computer vision, agent based modelling

Industry:

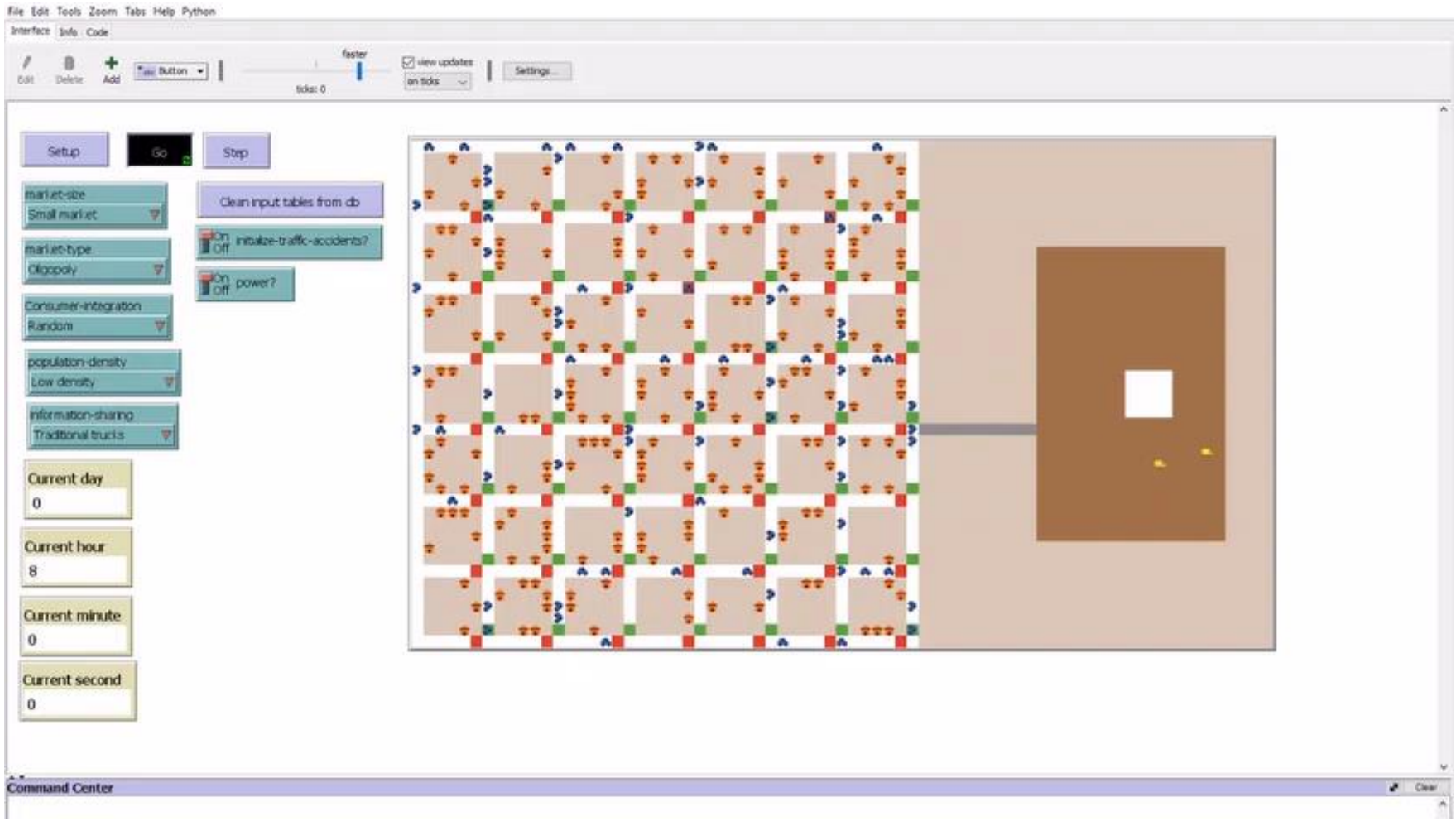
- CEO, AI Conformity & Research consulting
- Previously, CEO, Market Trend Valuation Center

Member:

- Member of Lithuanian PropTech Association, AI Association
- Expert for R&D evaluation, Innovation Agency Lithuania
- Technical committee, Lithuanian Standards Board.
- Advisory Working Group for "Digital technologies, industry, space" of the "Horizon Europe" programme, Lithuania Research Council.

Vilnius University

Urban logistics



Poultry health monitoring

Vilnius University

Get a good education, they said...
You will not need to do shit work, they said...

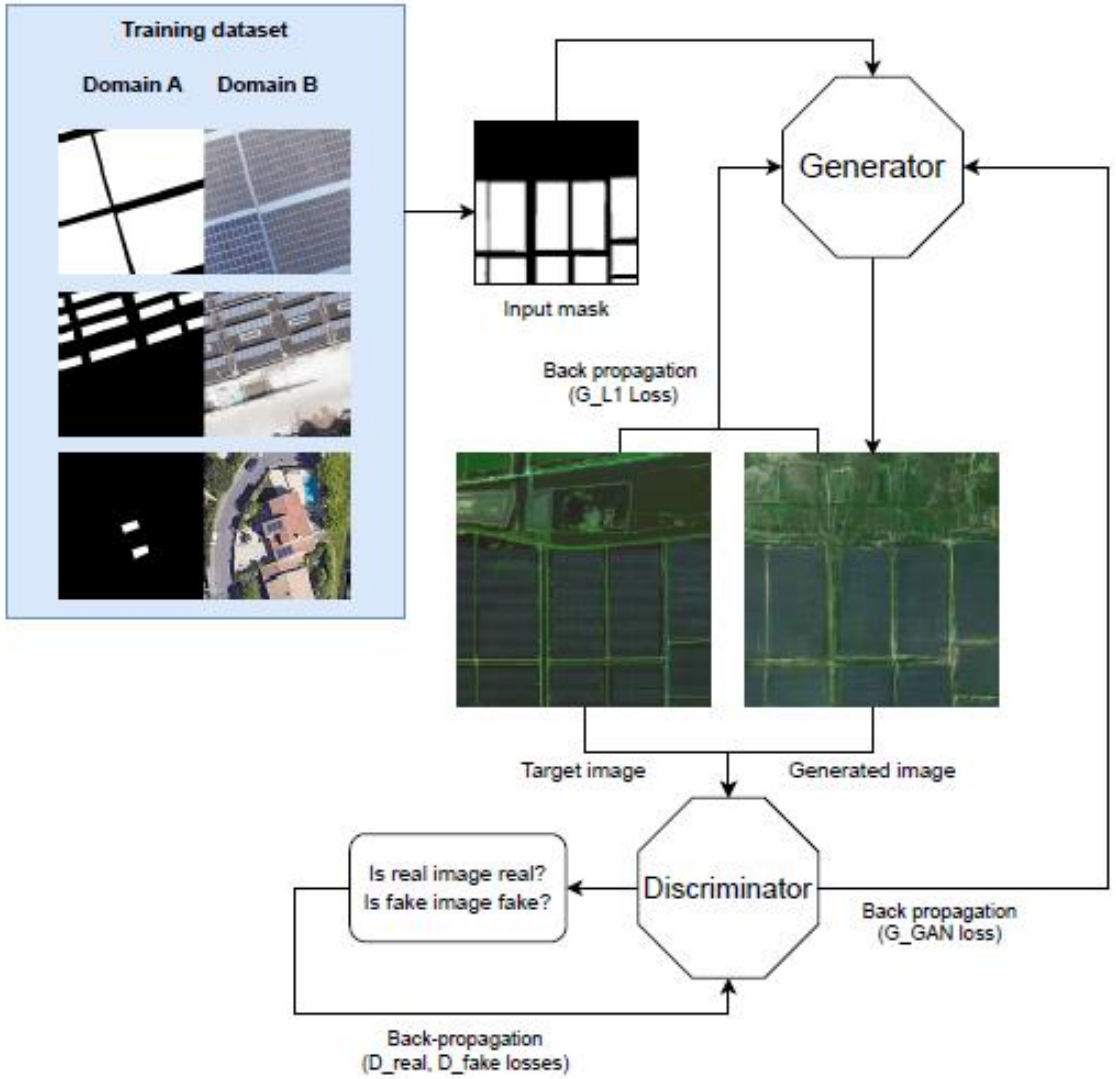
Research Article

Recognition and Classification of Broiler Droppings Based on Deep Convolutional Neural Network

Kategorija	Spalva
Norma	Dynamic (7)
Patologija	car (5)
Putota	bicycle (1)
Skysta	ground (0)
SkystaPutota	bridge (2)
SuLesaloLikuciais	traffic light (alt+8)
Background	pole (ctrl+7)

Solar Panel Segmentation from Remote Sensing Images

Vilnius University



Vilnius
University

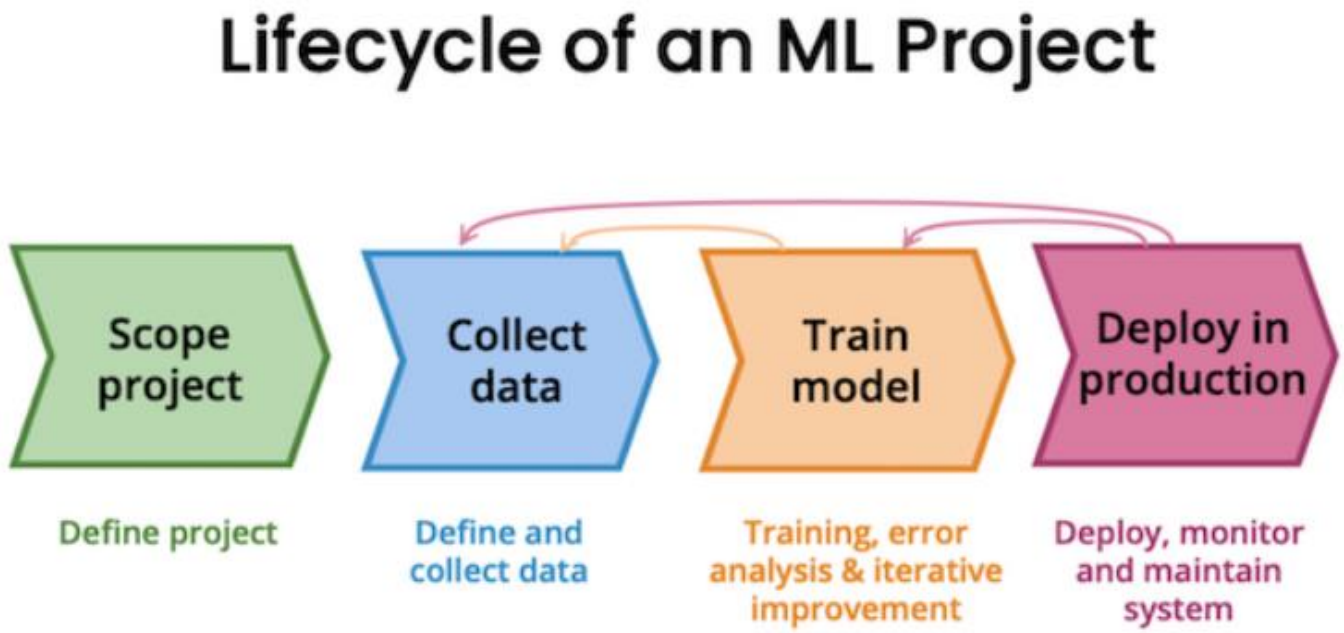
INTRODUCTION TO ARTIFICIAL INTELLIGENCE

dr. assoc. prof. Valentas Gružauskas

Vilnius University

Main steps

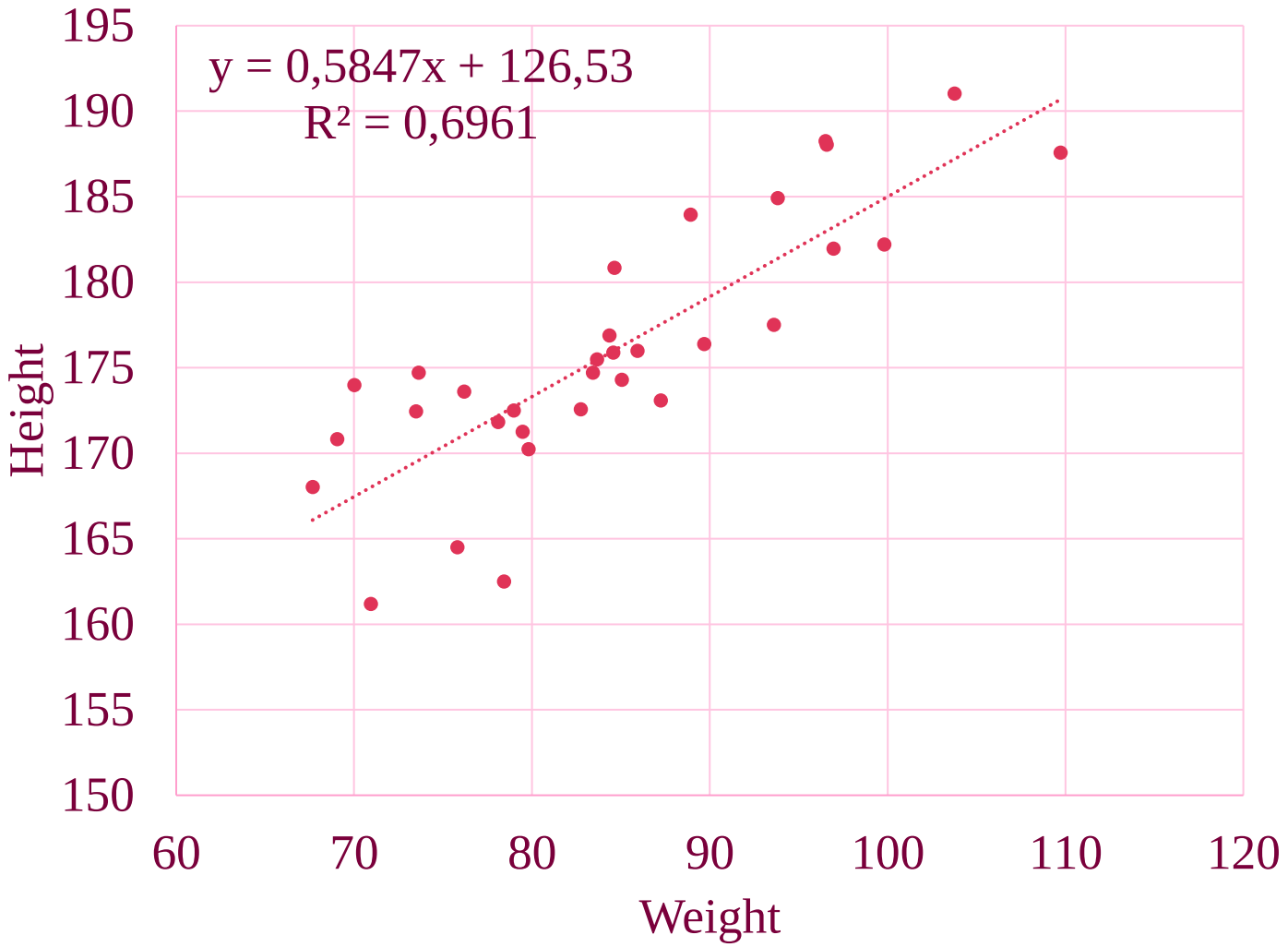
1. Collecting Data
2. Preparing Data
3. Choosing Important Information
4. Training the Model
5. Calibrating the Model
6. Making Predictions
7. Explaining Results



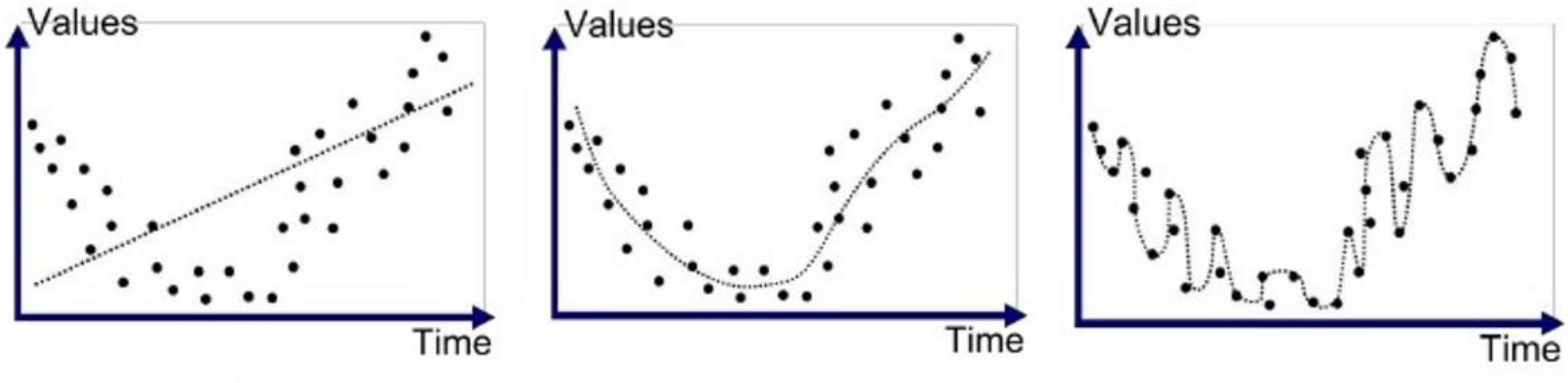
Linear regression example

Vilnius University

No.	Height	Weight	Forecasted height
1	188	110	191
2	175	74	170
3	188	96	183
4	182	100	185
5	177	94	181
6	171	69	167
7	175	83	175
8	174	76	171
9	170	80	173
10	161	71	168
11	181	85	176
12	182	97	183
13	165	76	171
14	176	86	177
15	176	85	176



Model fitting

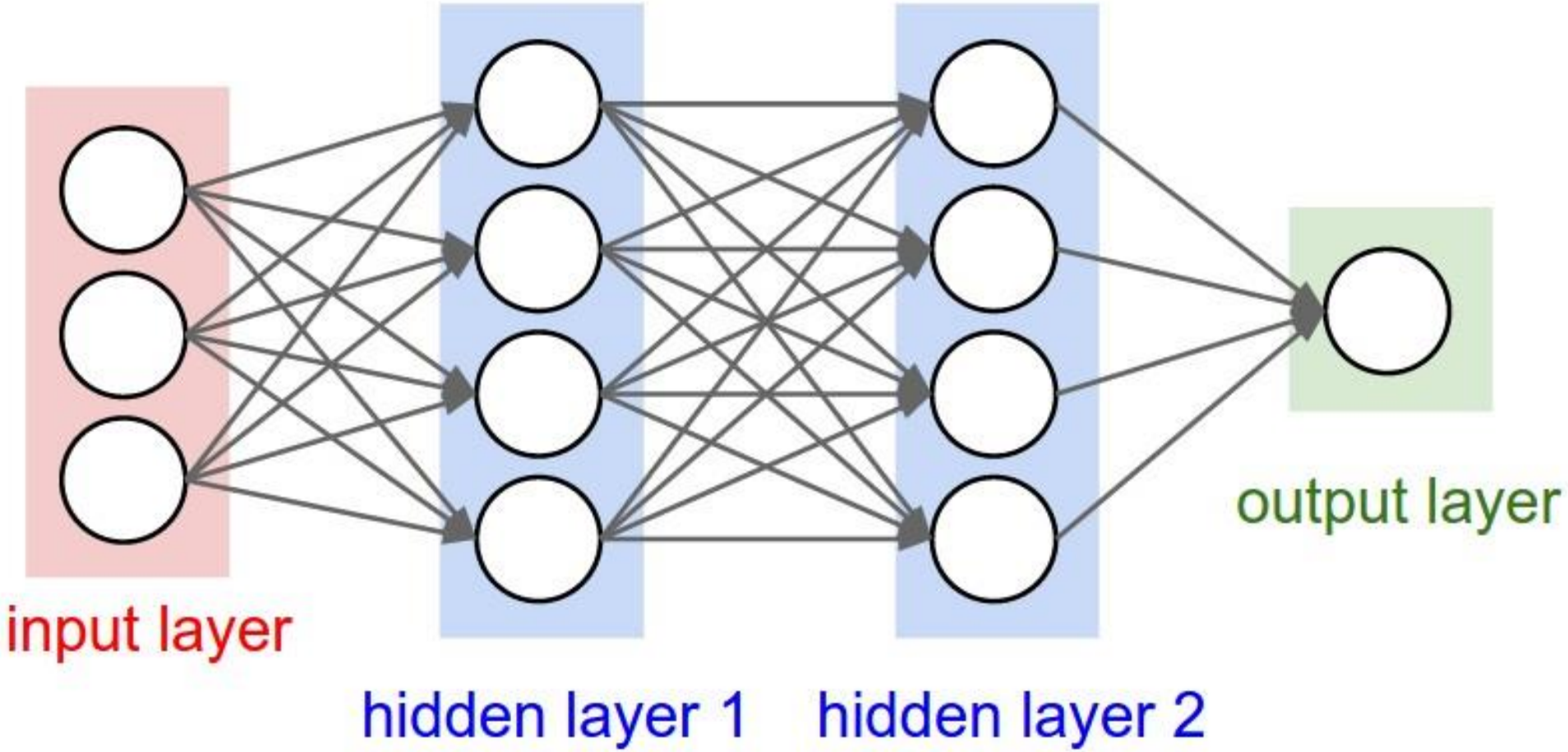


Underfitted

Good Fit/Robust

Overfitted

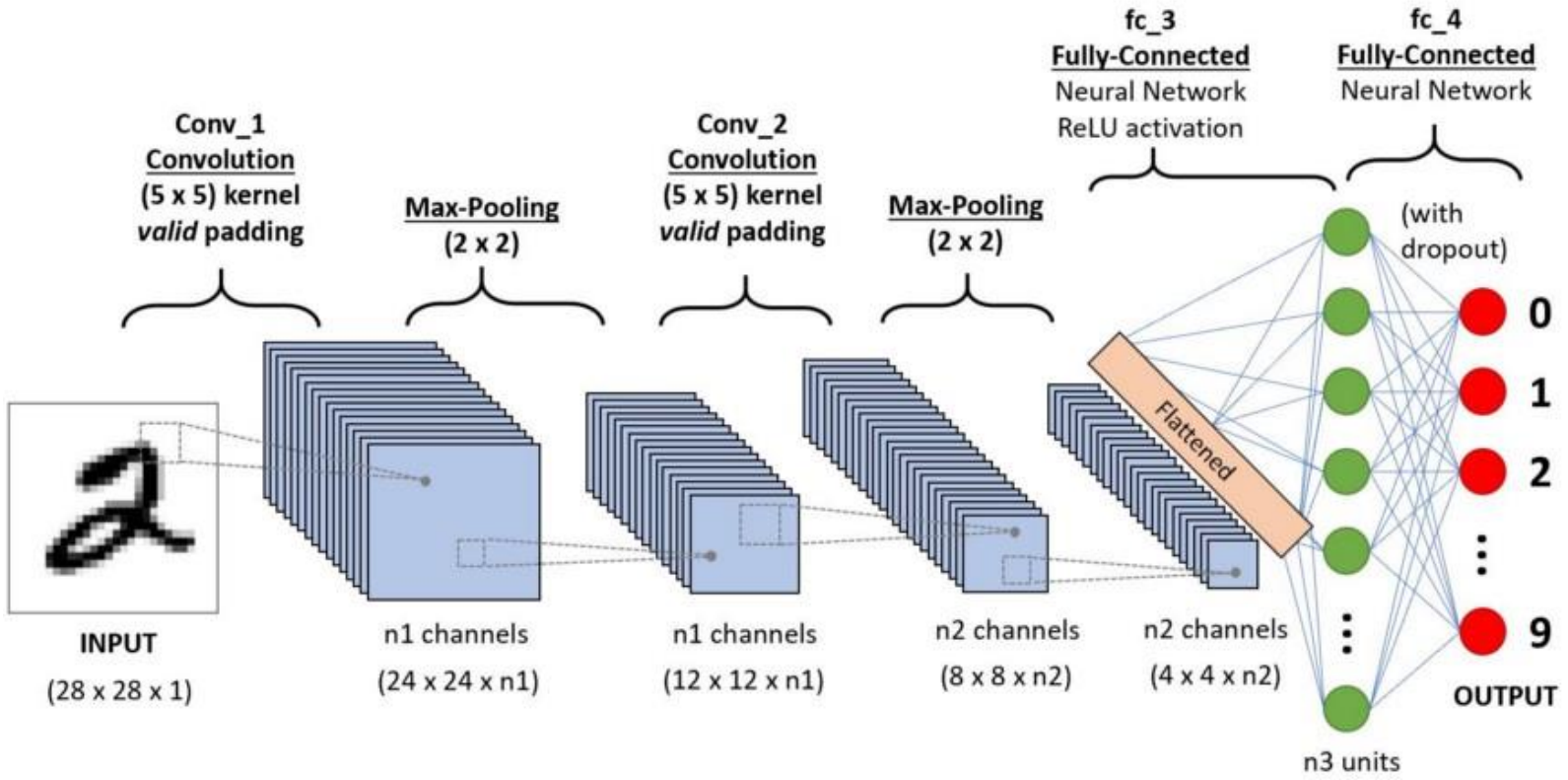
Neural networks



Vilnius University

Computer vision

Convolutional neural network (CNN) is a class of artificial neural network, most commonly applied to analyze visual imagery.



Source: Sumit Saha

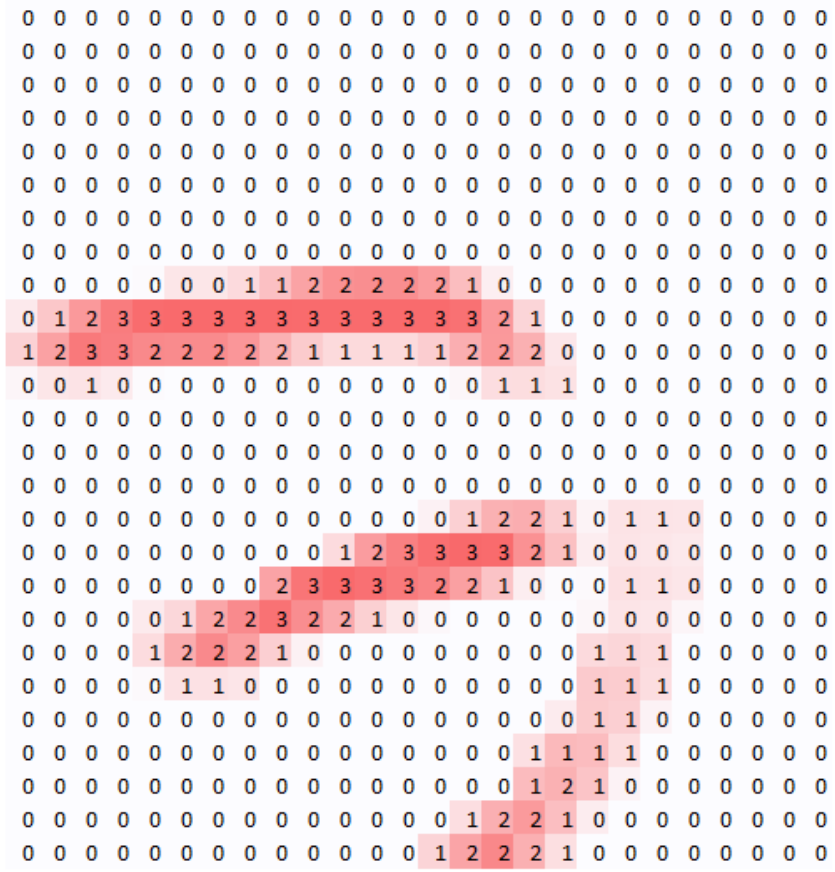
Vilnius University

Convolutional neural network

Learnable parameters (6 values)

filter 1/1

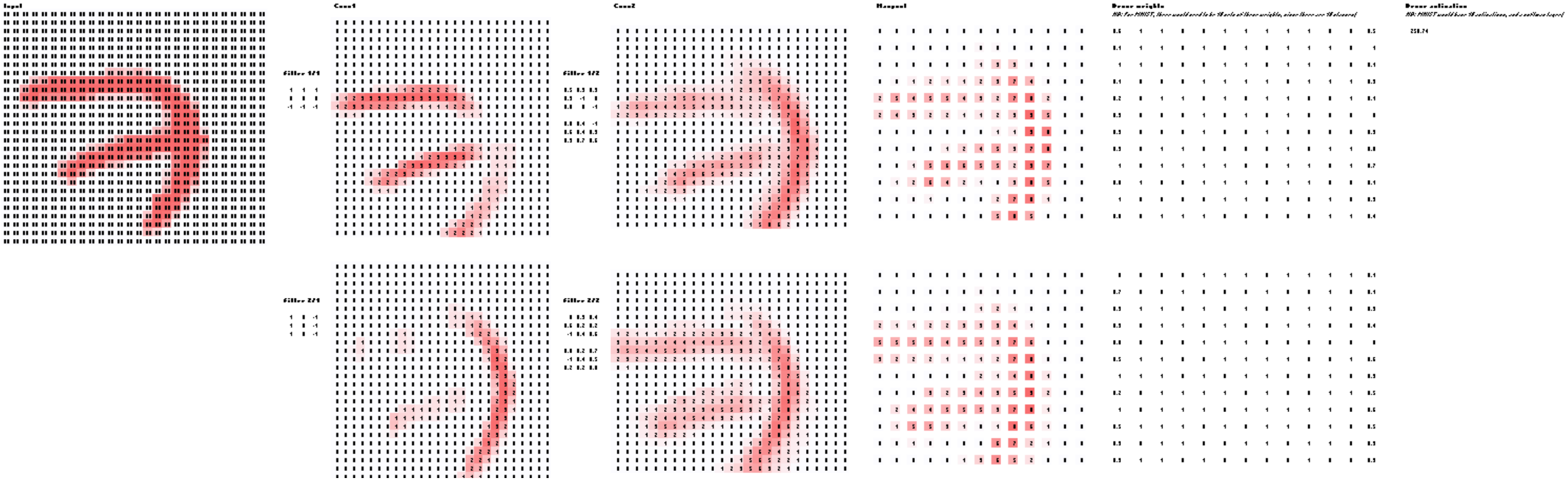
1	1	1
0	0	0
-1	-1	-1



Source: fast.ai

Vilnius University

Convolutional neural network



Source: fast.ai

Vilnius University

AI APPLICATION IN PEAT INDUSTRY

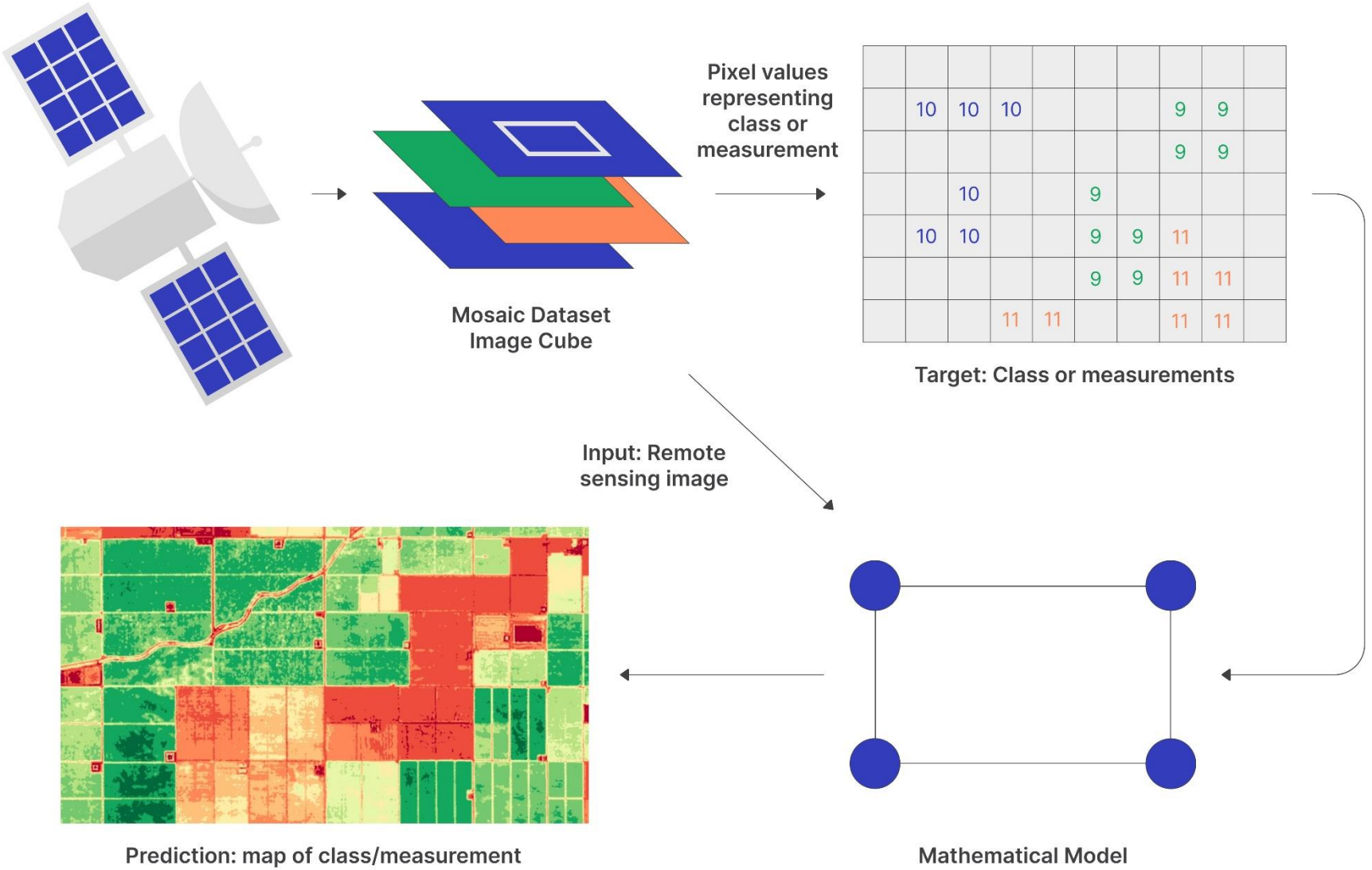
dr. assoc. prof. Valentas Gružauskas

Vilnius University

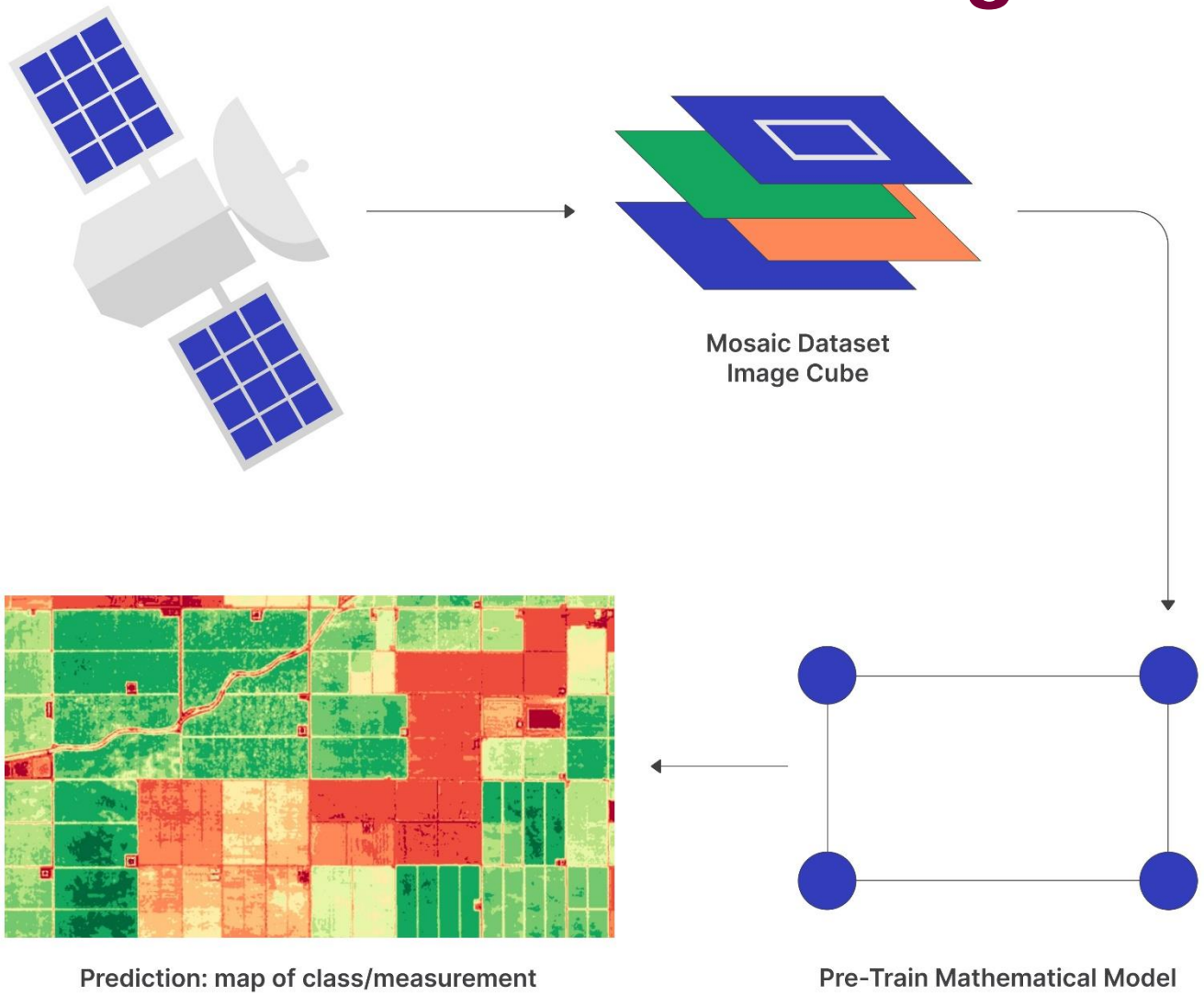
Possible application areas

- Peatland Hydration Forecasting
- Stored Peat Acidity Monitoring
- Harvest Timing Optimization
- Peat Quality Classification
- Transportation Route Optimization
- Supply Chain Disruption Prediction
- Peatland Restoration Planning
- Carbon Emission Monitoring
- Peat Storage Condition Prediction
- Other

Training: Linking Images to Measurements



Predicting: Measurements from Images

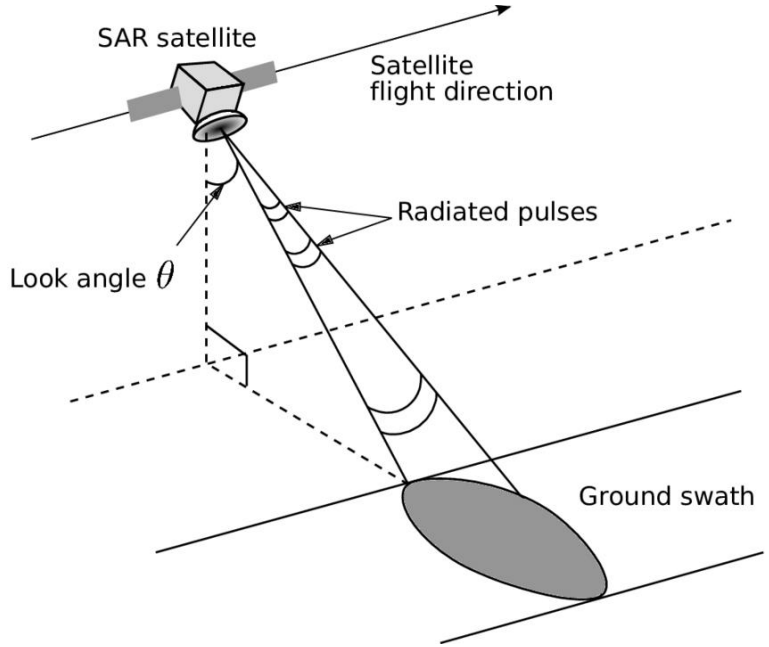


Synthetic Aperture Radar (SAR)

Vilnius University

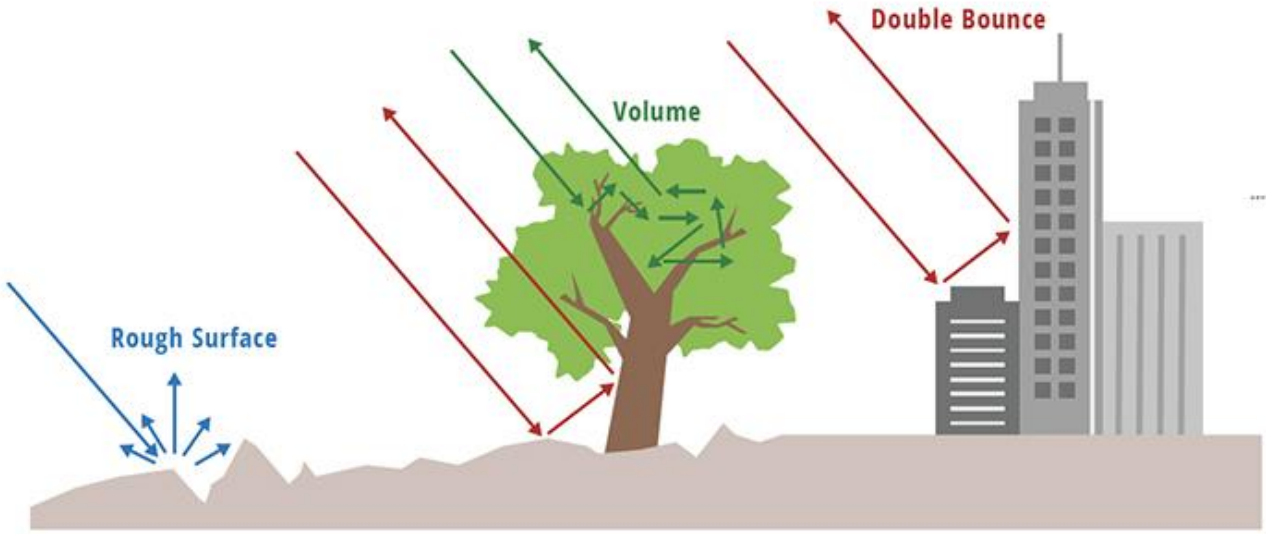
What is SAR?

- Remote sensing radar technology
- Works in all weather, day or night
- Creates detailed surface images



Earth Penetration & Humidity Measurement

- Penetrates vegetation, soil layers
- Measures soil moisture, peatland humidity
- Uses backscatter radar signals
- Key for environmental monitoring



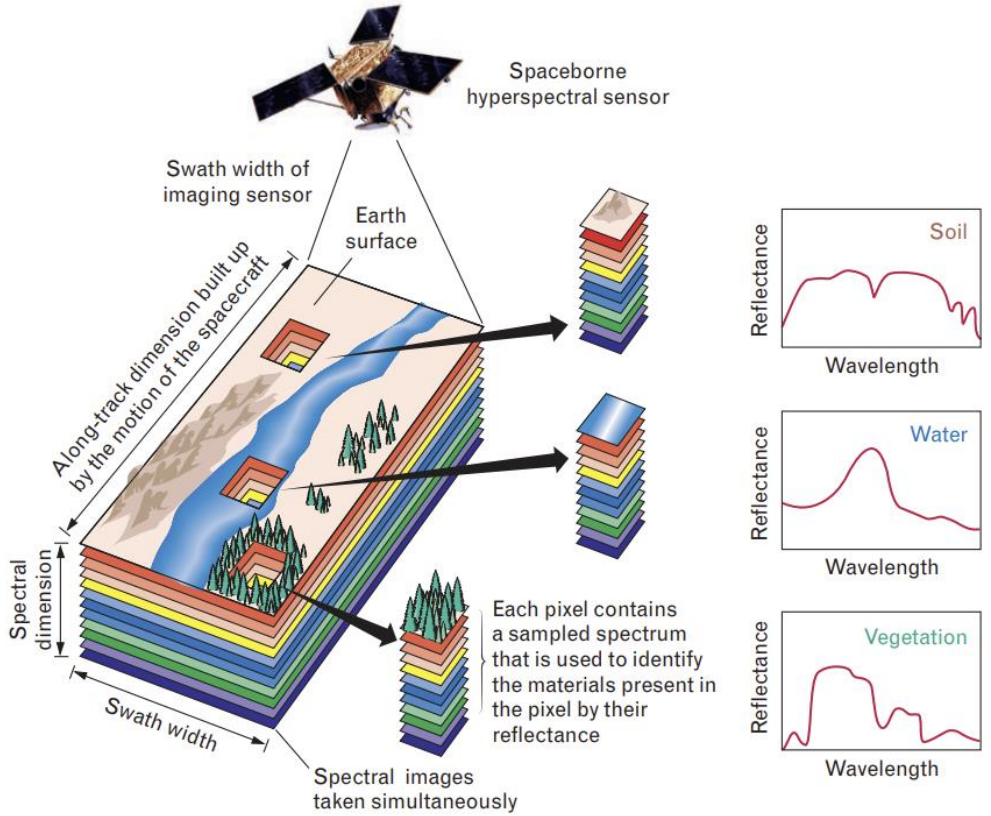
Hyper spectral satellite

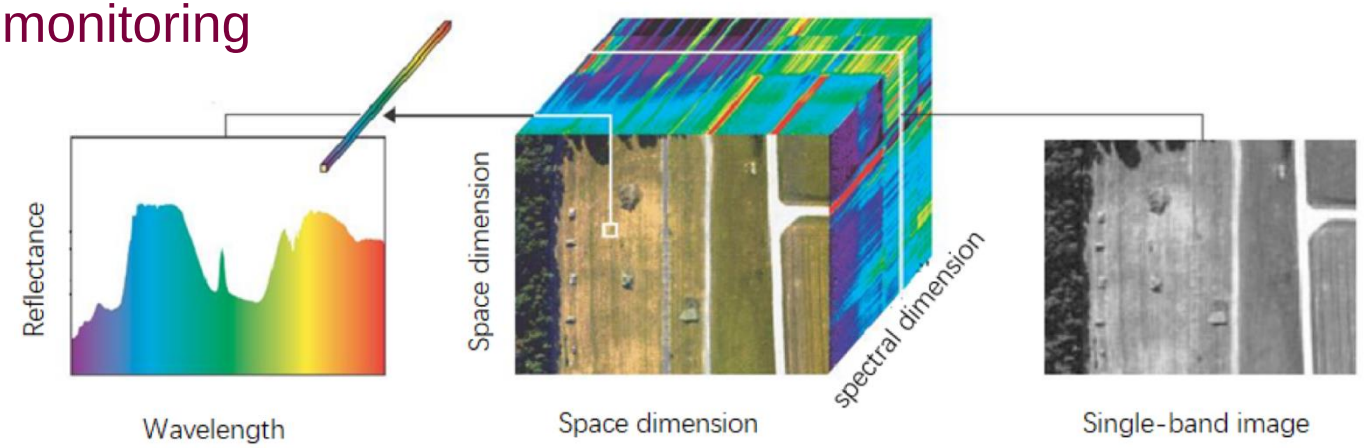
What is a Hyperspectral Satellite?

- Remote sensing with 100-200+ bands
- Captures detailed surface data

Material Identification and Soil Analysis

- Captures more detail than standard RGB cameras
- Identifies soil moisture, organic matter, minerals
- Used for soil analysis and environmental monitoring





Hydration level determination for harvesting

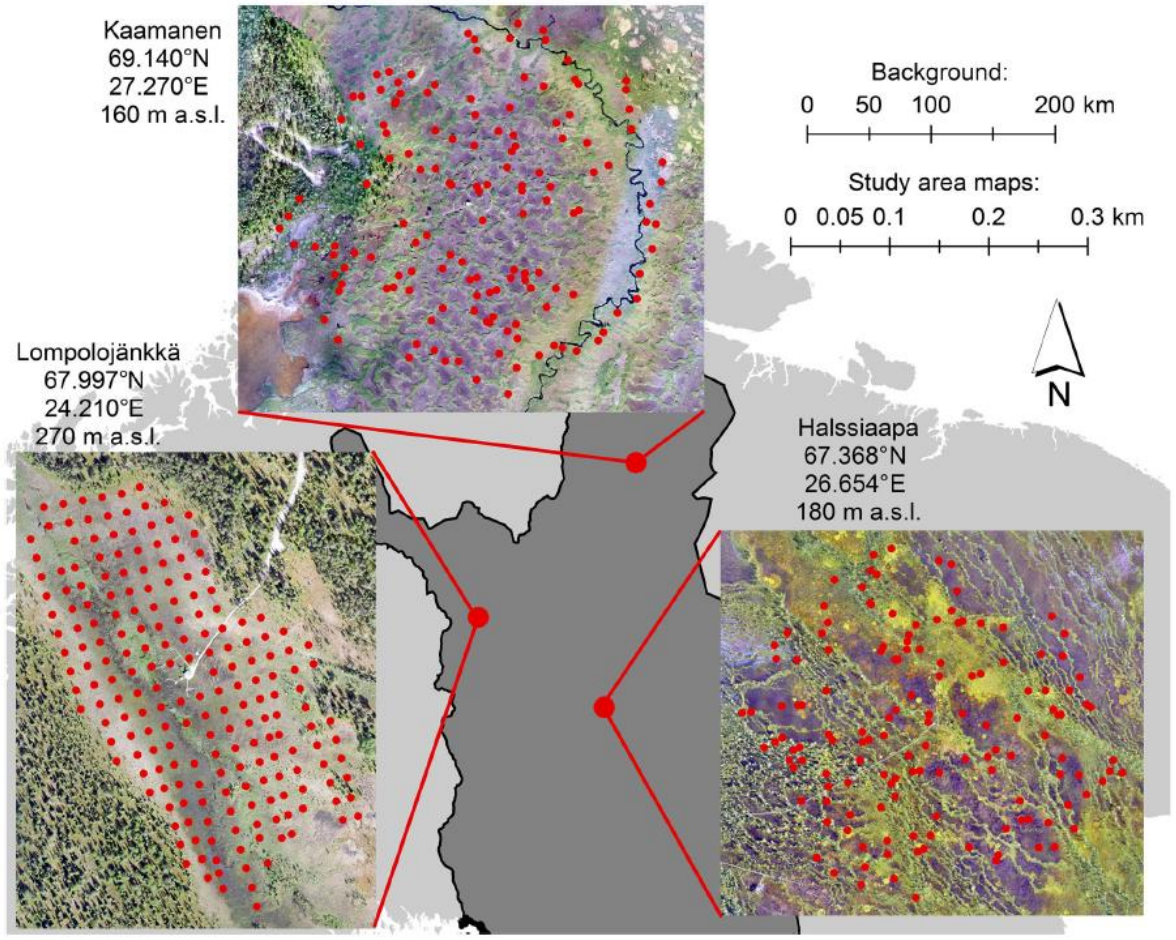
Vilnius University

Combining Data from Different Sensors

- Use information from RGB, infrared, and radar
- Match with real-world data like soil moisture and plant health
- Helps improve accuracy in monitoring

Predicting Hydration with Smart Models

- Use advanced computer models to understand hydration patterns
- Predict future hydration levels in peatlands
- Helps plan the best times for harvesting



Räsänen, A., Aurela, M., Juutinen, S., Kumpula, T., Lohila, A., Penttilä, T., & Virtanen, T. (2020). Detecting northern peatland vegetation patterns at ultra-high spatial resolution. *Remote Sensing in Ecology and Conservation*, *6*(4), 457-471.

Peatland fire simulation

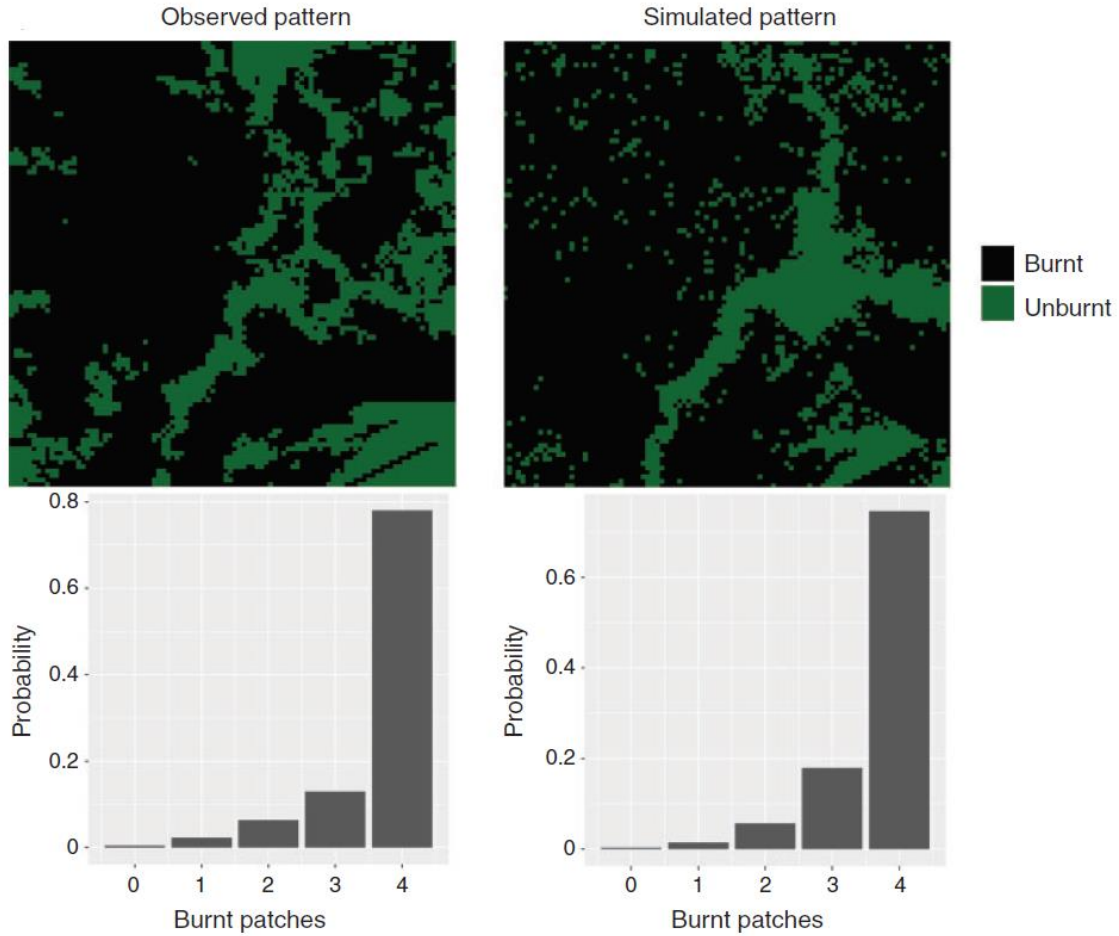
Vilnius University

Land Type & Change Prediction

- Use land type data over time
- Predict probability of land cover change
- Plan for environmental shifts

Fire Spread Simulation

- Use computer models to simulate fire spread
- Test different scenarios to improve fire prevention strategies



Widyastuti, K., Imron, M. A., Pradopo, S. T., Suryatmojo, H., Sopha, B. M., Spessa, A., & Berger, U. (2020). PeatFire: an agent-based model to simulate fire ignition and spreading in a tropical peatland ecosystem. *International Journal of Wildland Fire*, *30*(2), 71-89.

Vilnius University

LEGISLATION AND STANDARDS OF ARTIFICIAL INTELLIGENCE

dr. assoc. prof. Valentas Gružauskas

Artificial Intelligence Regulation

Vilnius University

- **AI Act -** The Artificial Intelligence Act was approved on August 1st, 2024 to establish clear rules for AI use.
- **AI Office** - The European AI Office oversees the enforcement and implementation of AI regulations.
- **Standards for AI** - Various standards exist, focusing on ethics, bias reduction, and risk management to ensure safe and fair AI use.

Vilnius University

ISO AI management standards

ISO 42001 AI Management System

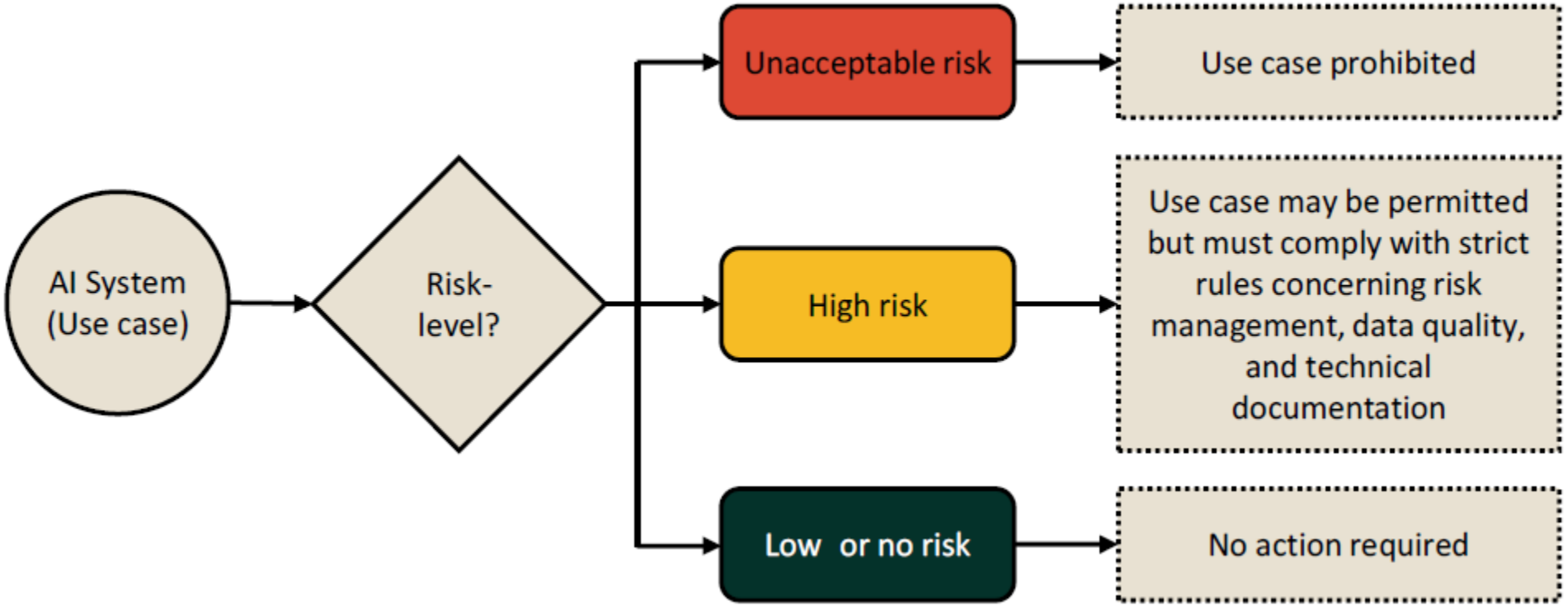
- Guidelines for **ethical AI use**
- Focus on **risk management** and **transparency**

ISO 23894 AI Risk Management

- Helps identify and reduce **AI risks**
- Ensures systems are **safe and reliable** throughout their lifecycle

Risk level and obligation

Vilnius University

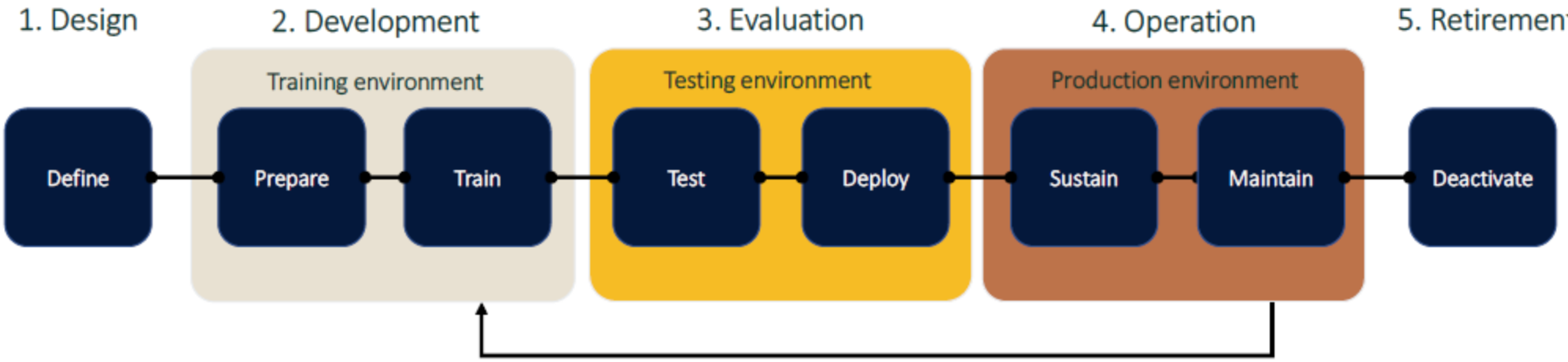


“Providers of low-risk AI systems should draw up and apply voluntary codes of conduct related to their internal procedures and the technical characteristics of the systems they design and deploy”.

Source: capAI

Vilnius University

AI process flow



Art. 10 AIA
Training data

- Correctness
- Representativeness
- Minimizing bias

Art. 11-13 AIA
Transparency & docs

- Deployment
- Application data
- Application

Art. 14 AIA
human in the loop

Art. 15 AIA
Performance

- Accuracy
- Robustness
- IT security

Vilnius University

CONTACTS

dr. assoc. prof. Valentas Gružauskas

AI Conformity and Research Consulting

Vilnius University

- AICR Consulting specialize in guiding organizations through the complexities of AI implementation and compliance with the new EU AI Act. Our comprehensive services ensure your AI systems are compliant with ISO standards, while also driving your R&D initiatives and enhancing your team's expertise in AI technologies.
- PECB Certified ISO/IEC 42001 Lead Implementer (in progress)

Services:

•AI Standards Compliance;

•R&D Project Development;

•Scientific Literature Analysis;

•Methodology Development;

•Employee Training Programs.

Vilnius University

Contacts

dr. assoc. prof. Valentas Gružauskas

https://aicrconsulting.com/

https://www.linkedin.com/in/valentasgruzauskas/

v.gruzauskas@gmail.com

+37068576870