visuAAL

Privacy-Aware and Acceptable Video-Based Technologies and Services for Active and Assisted Living

ESR 16 - Irakli Pkhakadze, LL.M. Oslo/Hannover

Research Assistant

Stockholm University, The Swedish Law and Informatics Research Institute (IRI).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 861091".

Universitat d'Alacant
Universidad de Alicante
Project Coordinator

RWTH AACHEN UNIVERSITY

Stockholm University

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

TU WIEN

Digital twins as a way to help ensure legal compliance of video-based AAL technologies

Research Overview

1. Research Focus: Utilizing Digital Twins for data simulation and anonymization
2. Primary Goal: Compile a comprehensive report on Digital Twins in AAL Environments for data privacy
3. Challenges in AAL: Video-based technologies pose significant privacy risks
4. Necessity of Compliance: Legal adherence is crucial for the acceptance and sustainability of AAL technologies

Study Problem:

"Need to find solutions that ensure compliance without compromising personal data integrity. ensuring privacy and legal compliance is crucial for the adoption of AAL technologies."

- Legal compliance
- Ethical implications
- Practical implementations

Objectives of The Research

- Examine Digital Twins as tools for data simulation and anonymization
- Analyze GDPR's impact on DT’s in AAL technology deployment
- Assess social, ethical, and legal challenges of Digital Twins.
- Review research and practical implementations of Digital Twins
- Providing a systematic review of other regulatory frameworks governing Digital Twins in AAL environments

Relevance of Discussing Digital Twins in AAL Legal Compliance

Clarifies legal obligations for developers and deployers

Applicable regulations: AI Act, MDR

Emphasizes safety and reliability

Crucial for healthcare applications

Aligns with regulatory requirements

Ensures legal compliance fosters innovation in AAL technologies

Definition

"Dynamic and comprehensive virtual model that mirrors the physical, functional, and behavioral characteristics of a real-world entity or system across its lifecycle. This simulation integrates multi-physics and multi-scale data, uses real-time updates and AI algorithms to replicate and predict the state and performance of its physical counterpart, facilitating optimization, monitoring, and decision-making within an interconnected physical and virtual environment"

1960

NASA's Early Applications

Apollo 13 mission: first practical digital twin to simulate real-time conditions.

1991

Early Conceptualization

software models reflecting physical world data input

2002

Introduction of Digital Twin Framework

Michael Grieves introduced the DT framework in Product Lifecycle Management (PLM)

"Mirrored Spaces Model."

2010

NASA's and US Air Force's Official Adoption of the Term

2015-2020s

Advancements in Various Industries

Manufacturing: simulation capabilities, reducing physical prototypes

2019

Conceptual Refinement

Michael Grieves refined the DT framework, emphasizing comprehensive understanding across various fields.

Current state

Broader Impact and Complex System Applications

Smart Energy Grids, Sociotechnical Systems, manufacturing plants, ergonomic simulations, livestock farming, and urban systems.

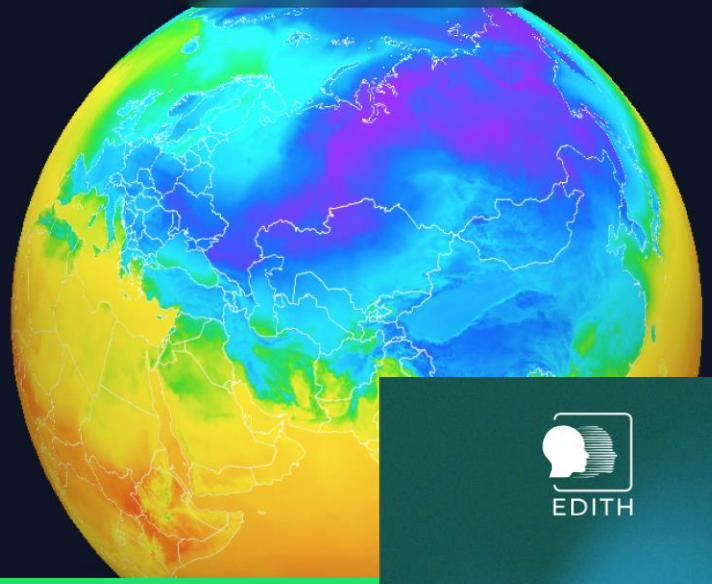
Destination Earth

Home Services Onboarding Updates About Support

Sign In

1 month of DestinE Climate DT (2025)

JAN FEB



DestinE Platform

Your gateway to a sustainable future

A unique ecosystem of services harnessing the power of Destination Earth.

19

Services already available

Explore

EDITH

Project Roadmap Crowdsourcing Dissemination Consortium Advisory Boards Get Involved

EDITH

European Virtual Human Twin

FINAL EDITH-CSA ECOSYSTEM MEETING: 15-16 JULY 2024, KIT ROYAL TROPICAL INSTITUTE, AMSTERDAM, THE NETHERLANDS

Sign up at the:
EDITH-CSA Ecosystem Meeting!

Digital Twins for Elderly Care

Individualized Care Plans

- Mental Health Support
- Physical Rehabilitation
- Medication Management

Optimized Living Environment

- Comfort and Safety Improvements
- Smart Home Technology

Cognitive Support

- Decision Assistance
- Memory Aids

Social Engagement

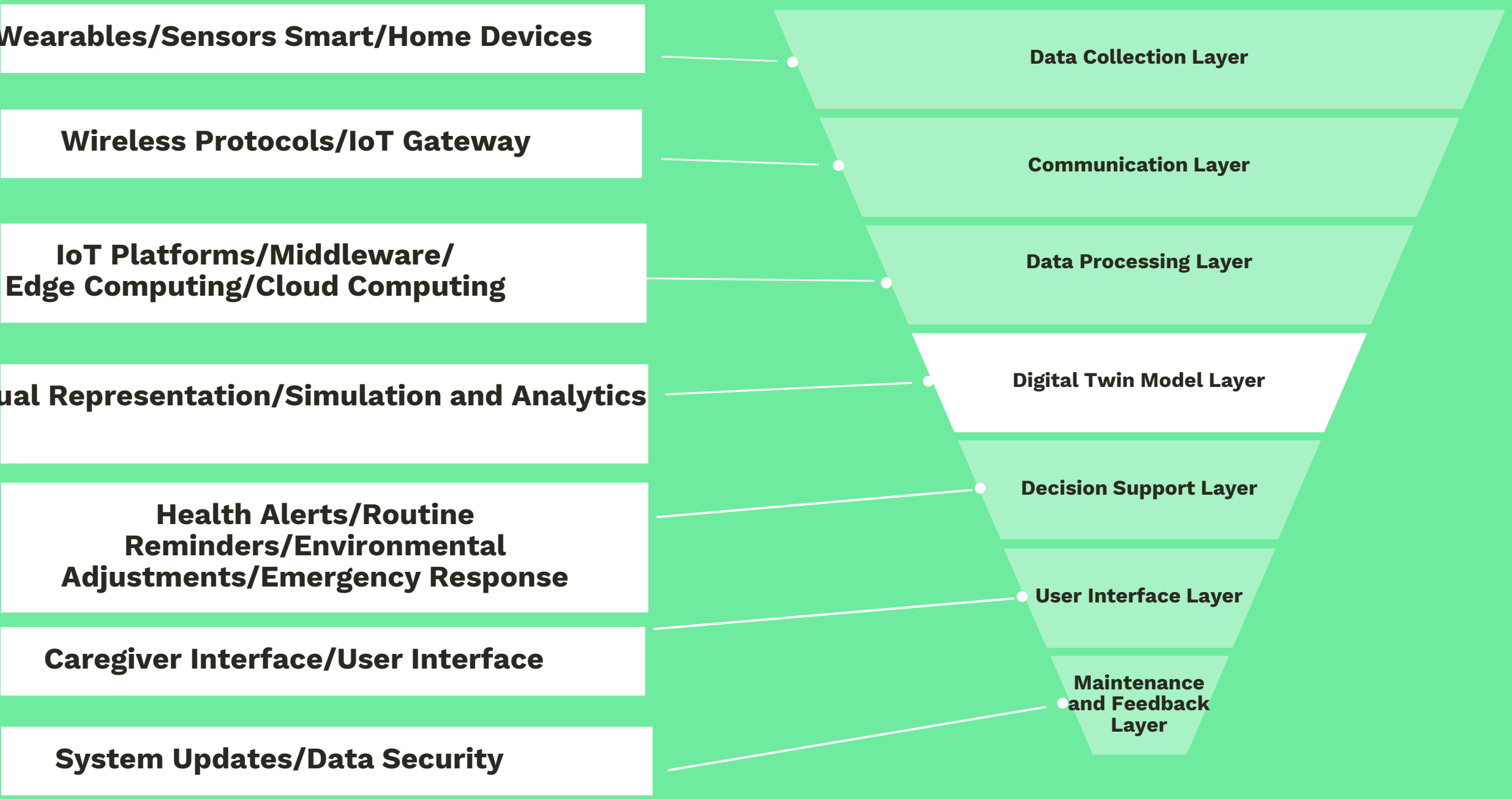
- Social Activity Planning
- Family Communication

Health Surveillance

- Vital Signs Monitoring
- Dietary and Nutrition Management
- Physical Activity Tracking

Emergency Services

- Fall Detection
- Medical Alert System


Wearables/Sensors Smart/Home Devices
Wireless Protocols/IoT Gateway
IoT Platforms/Middleware/
Edge Computing/Cloud Computing
ual Representation/Simulation and Analytics
Health Alerts/Routine
Reminders/Environmental
Adjustments/Emergency Response
Caregiver Interface/User Interface
System Updates/Data Security
Data Collection Layer
Communication Layer
Data Processing Layer
Digital Twin Model Layer
Decision Support Layer
User Interface Layer
Maintenance
and Feedback
Layer

Strategies for Data Privacy in AAL

Anonymization & Pseudonymization

Permanently removing identifiers

Replacing identifiers with pseudonyms

Generative Adversarial Networks (GANs)

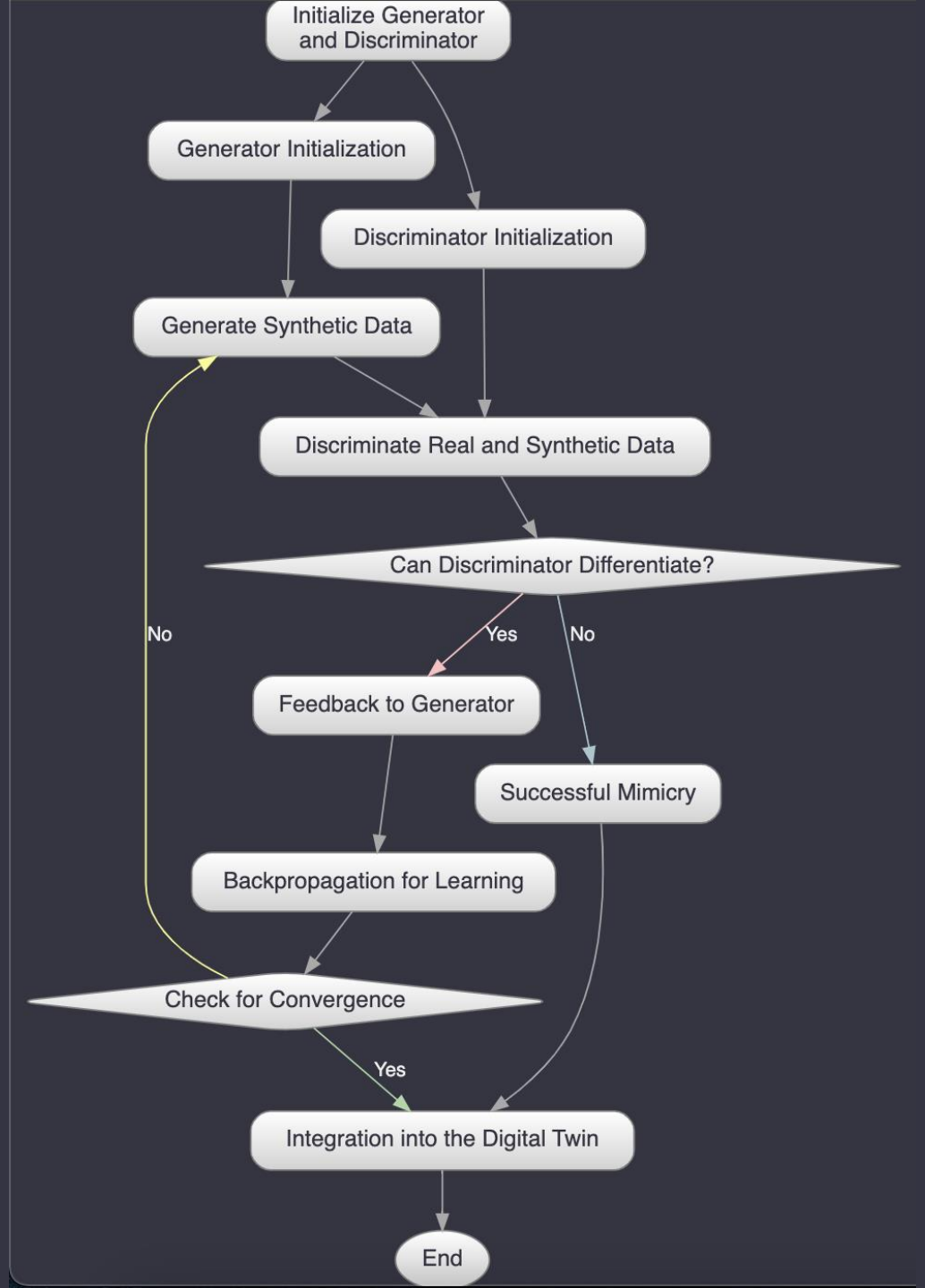
Edge Computing

Local data processing to minimize network transfer

Federated Learning & Privacy-Preserving Analytics:

Secure, decentralized data processing

Techniques like differential privacy and homomorphic encryption


Initialize Generator and Discriminator
Generator Initialization
Discriminator Initialization
Generate Synthetic Data
Discriminate Real and Synthetic Data
Can Discriminator Differentiate?
No
Yes
No
Feedback to Generator
Successful Mimicry
Backpropagation for Learning
Check for Convergence
Yes
Integration into the Digital Twin
End

High-Risk AI Systems:

AI in **diagnosis**, **monitoring physiological processes**, and **therapeutic decision-making**.

Regulatory Context:Medical Devices Classification:

AI in healthcare often qualifies as **Medical Device software**.Requires **'conformity' assessment** by regulatory authorities.

AI Act and High-Risk Classification:AI Act Framework:

AI integrated into software needing Medical Device conformity assessment is **high-risk AI**.

Q&A

Thank You!