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DI URBINO  
CARLO BO

# SMARTPHONE BASED POSTURAL STABILITY MONITORING SYSTEM FOR FALLS PREVENTION IN THE ELDERLY

INDUSTRIAL INNOVATION PHD

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# The Project

**“SMARTPHONE BASED POSTURAL STABILITY MONITORING SYSTEM  
FOR FALLS PREVENTION IN THE ELDERLY”**

## R&D Partners



UNIVERSITÀ  
POLITECNICA  
DELLE MARCHE



TECHNISCHE  
UNIVERSITÄT  
WIEN  
Vienna | Austria



# Agenda

## Present

- **Introduction to Digital Health**
- **Human Standing Balance**
- **Monitoring Human Balance with Smartphone**
- **Collected Data**
- **Research investigations**

## Plans

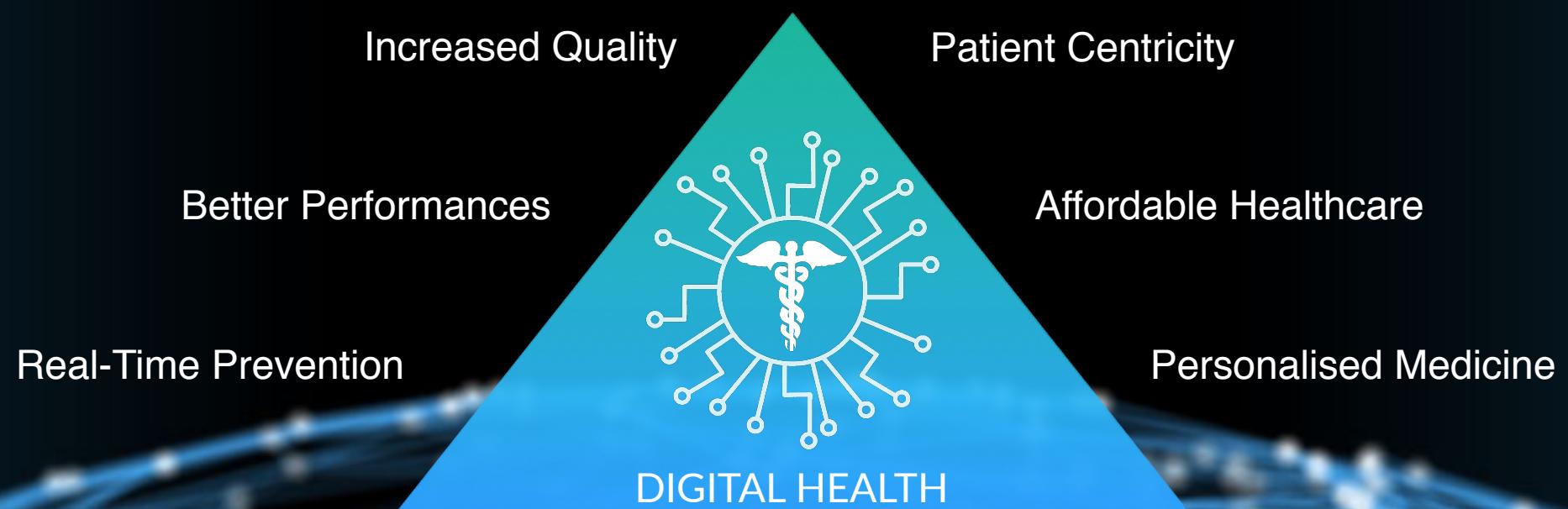
- **Forward Artificial Intelligence**
- **AI Investigations**

## Conclusions

- **First Year Summary**
- **R&D Roadmap to the End**

# Introduction to Digital Health

Digital Health is the **use of information and communications technologies to improve human health, healthcare services, and wellness for individuals and across populations.**



# Human Standing Balance

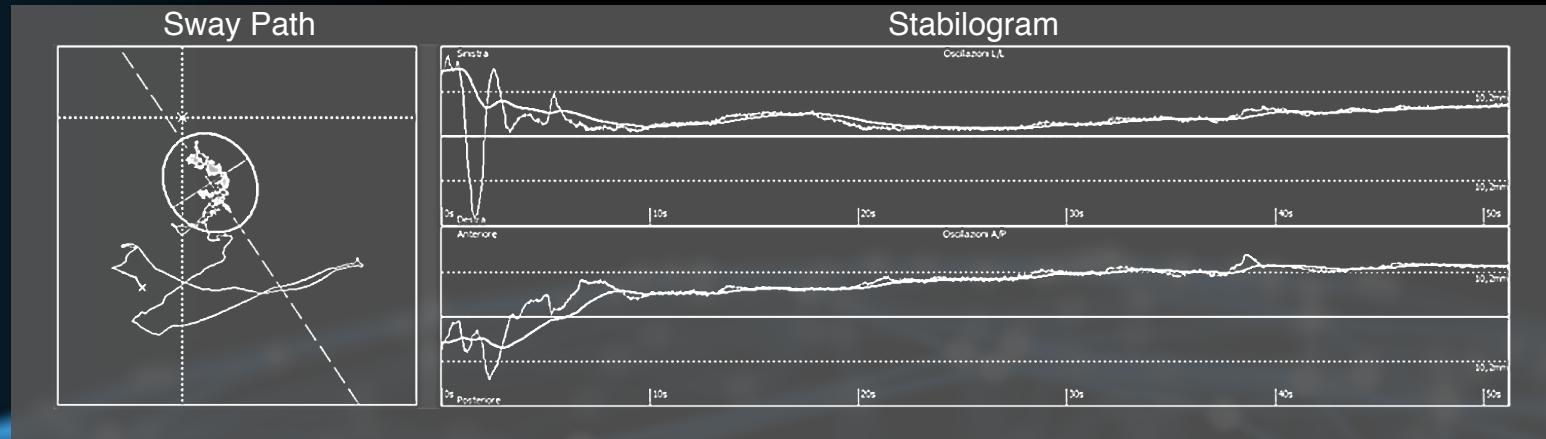
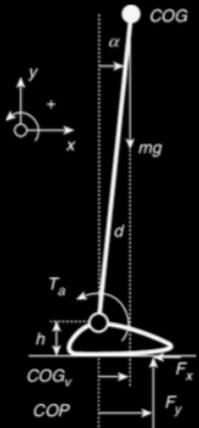
Traditional Posturographic Analysis

## Posture Evaluation

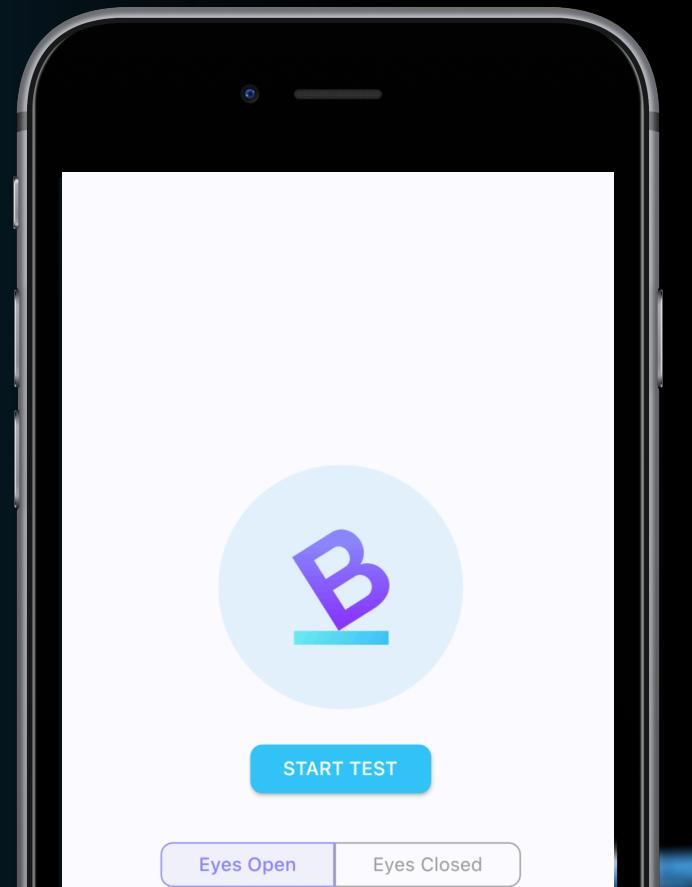
- Static
- Dynamic

## Features

- Center of Pressure
- Center of Gravity



# Monitoring Human Balance with Smartphone



## Balance

Your personal posture evaluator

- Fall Prevention by Posture Evaluation
- Privacy Safe
- Progress Statistics



**Fast.**

Download it from the App Stores



**Easy.**

One button to press



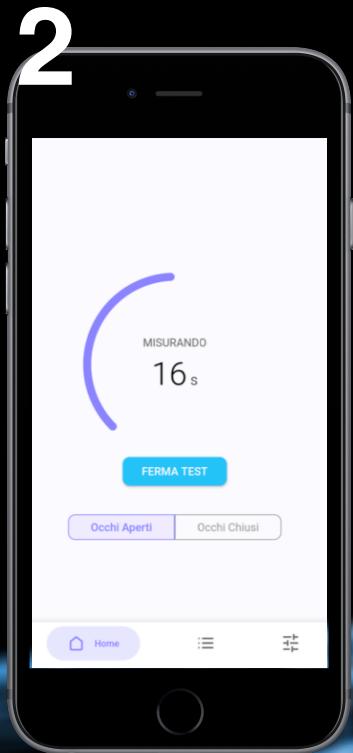
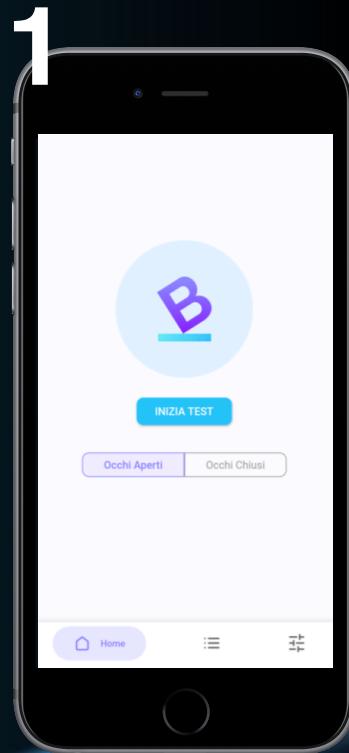
**On your smartphone.**

Always with you

# Monitoring Human Balance with Smartphone

Our Solution

By Using Accelerometers and Gyroscopes<sup>1</sup>



<sup>1</sup>"Standing Balance Assessment by Measurement of Body Center of Gravity Using Smartphones", Lattanzi E. et al., IEEE  
Author: Mr. Giacomo Bigini

# Collected Data

We do not store sensitive data

## Data we store

- Sway Path
- Stabilogram

## Data we are aiming to

- Personal Information
- Posture Information
- Injuries
- Deficiencies

## Personal Information

- Age
- Gender
- Height
- Weight

## Injuries

- Other Injuries

## Postural Information

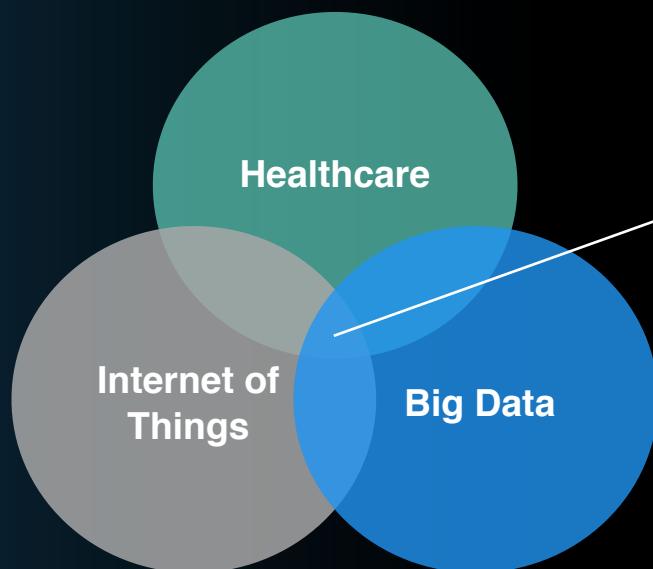
- Injuries
- Family Inheritance
- Medicines

## Deficiencies

- Visual Defects
- Hearing Defects

# Research Investigations

Investigating the Domain



## Internet of Medical Things

### OPPORTUNITIES

- Machine Learning Techniques for Personalised Medicine
- Self-Monitoring

### ISSUES

- Security & Privacy Regulations
- Data Management
- Data Ownership

# Research Investigations

Investigating Available Solutions

## Centralised Systems

- Central Authority
- Providers have the Power
- Providers Dependent
- **Mature**



## Distributed Systems

- Flexible Authority
- Decentralised Power
- Peers Dependent
- **Stable**



## Fully Decentralised Systems

- No Central Authority
- Peers have the Power
- Peers Dependent
- **Recent**



# Research Investigations

The Data Management and Ownership Issue

	Free Data	Reducing Features	Leverage the National Healthcare System	Decentralised Solution
Pro/Cons	Easy	Less Features	Relentless	New
Data Ownership	Anyone	Anyone	Service Provider	Creator
Privacy Risk	No Privacy	Low	Low	Privacy Focused

# Research Investigations

Forward a User Centric Data Management System Approach for Healthcare

*Peers  
“People have the Power!!!”, Patty Smith, 1988*



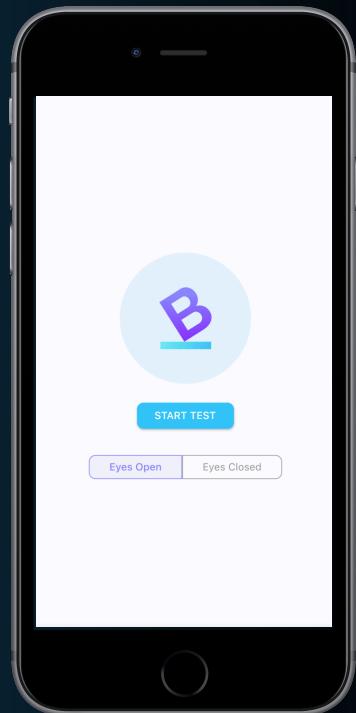
Sound easy? Well, It is not



A Review on Blockchain for the Internet of Medical Things:  
Definitions, Challenges, Applications, and Vision

Authors: Bigini G., Freschi V., Lattanzi E.

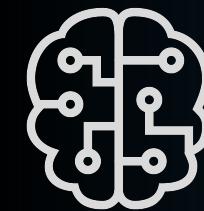
# Forward Artificial Intelligence



## Balance

Fostering your healthy posture behaviours while enjoying life

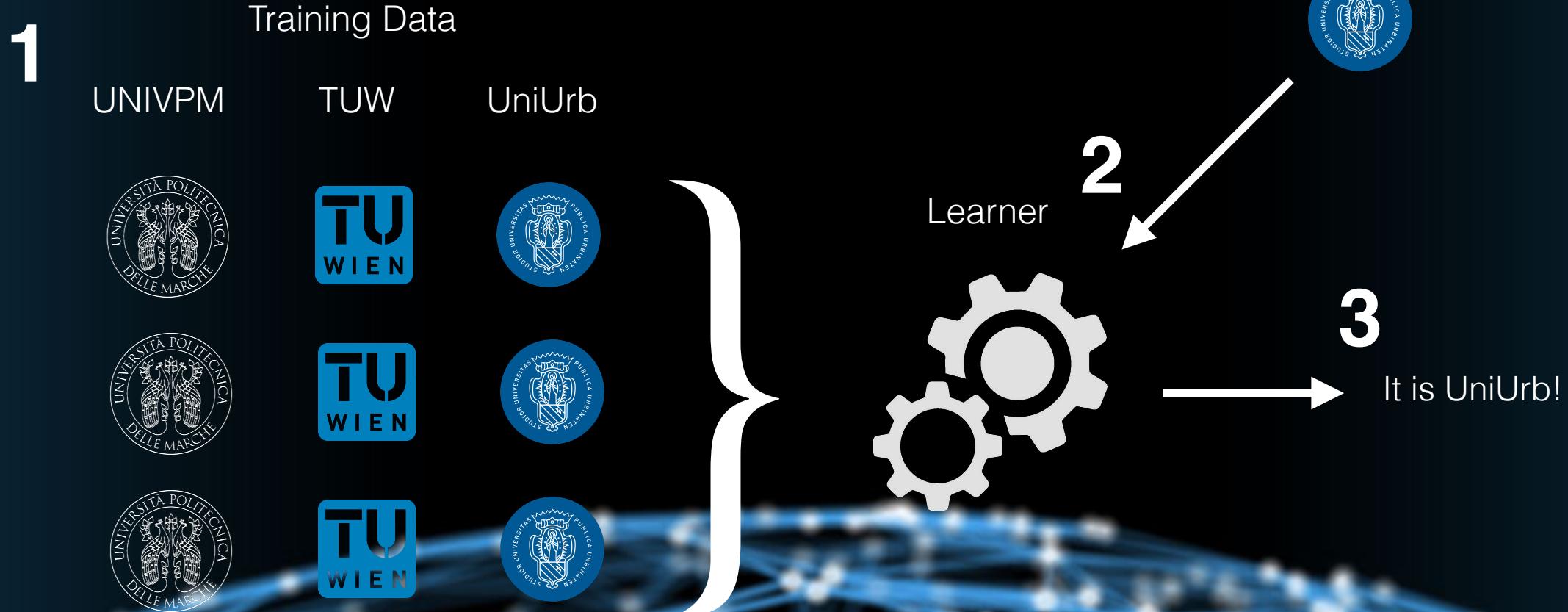
- Fall Prevention by Posture Evaluation
- Privacy Safe
- Progress Statistics
- You Own Your Data
- Personalised Recommendations



→ Artificial Intelligence

# AI Investigations

Machine Learning made easy



# AI Investigations

The Learning Issue

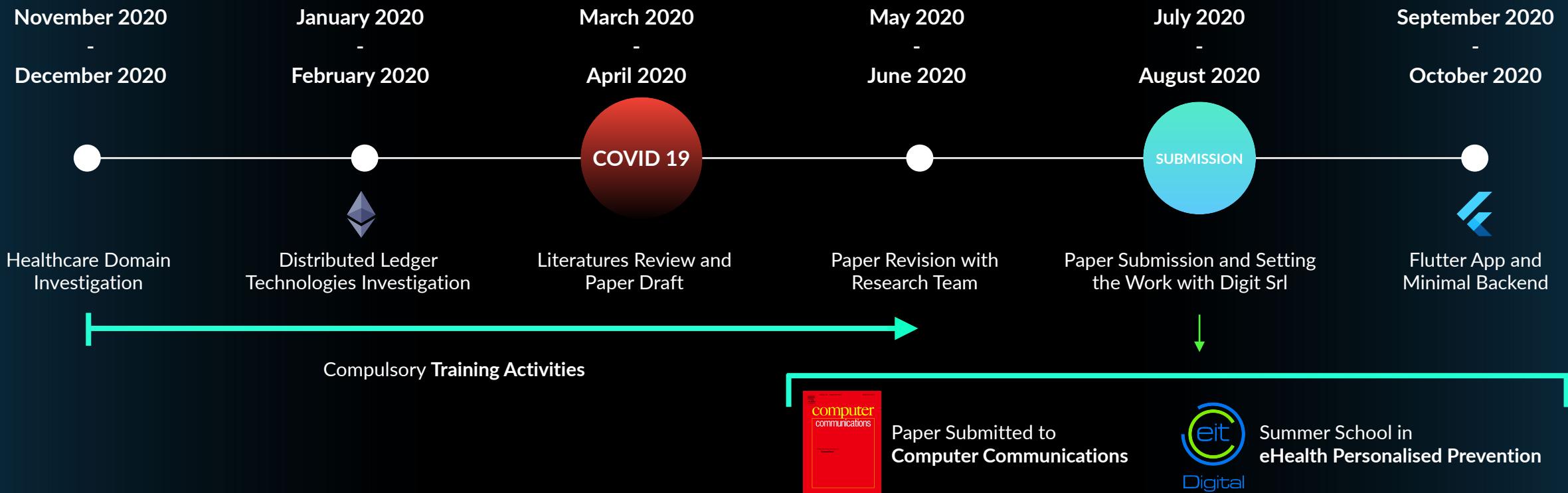
## Traditional Machine Learning needs:

- Use data in known positions
- Data masked
- A central authority
- Authority is the final owner

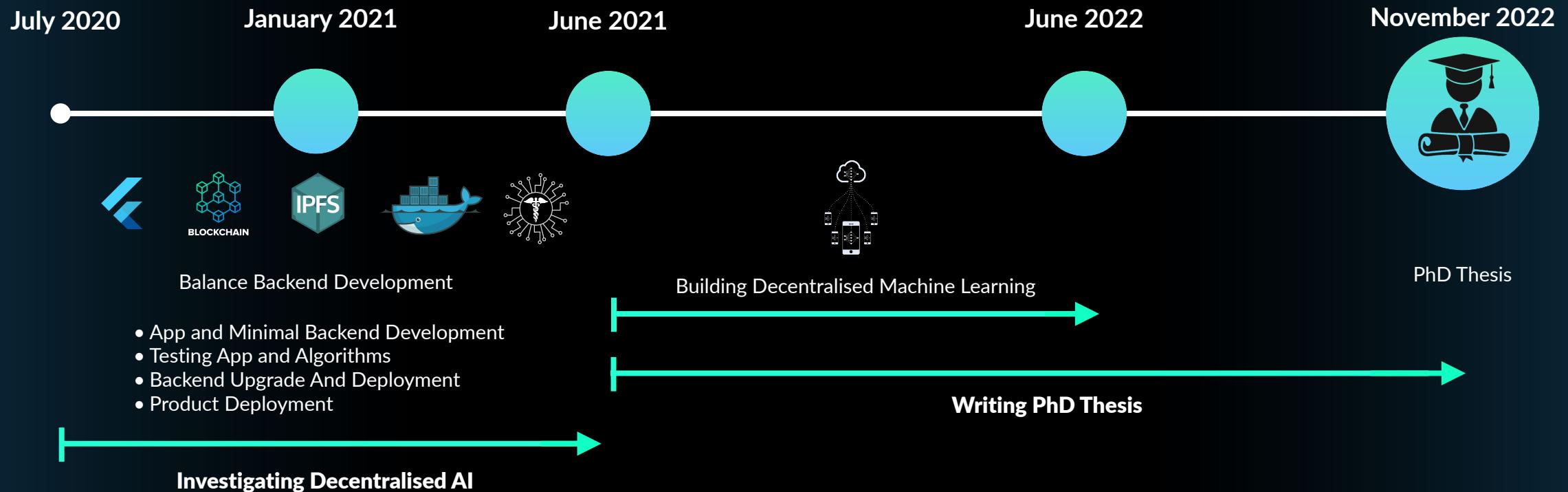
## Decentralised Machine Learning should:

- Use data in available positions
- No need for data masking
- No need for a central authority
- No need to own the data

# First Year Summary



# R&D Roadmap to the End





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Ph.D. Student University of Urbino

Thanks  
**For Your Attention**