frail ♡ safe

Sensing and predictive treatment of frailty and associated co-morbidities using advanced personalized models and advanced interventions

Prof. Vasilis Megalooikonomou

Computer Engineering and Informatics Dept.

University of Patras, Greece

FRAILSAFE Final Event, Apr. 3, 2019

www.frailsafe-project.eu

Data acquired through devices

frail safe

indoor and outdoor
monitoring

Older person
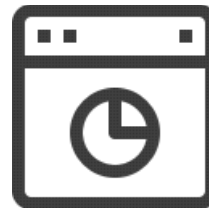
mobile and augmented
reality games

smart
garment

Dashboard

Third parties'
devices

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Measurable parameters and units of measurement

Sensorized vest/strap with 9 DoF IMUs → Heart rate, respiration rate, posture and/or activity, steps/minute, falls, instability

Smartphone → Indoor/Outdoor activities, Physiological state, Motor state, Social Interaction

Questionnaires → Nutrition, Social Interaction, Cognitive state

Medical record → Co-morbidities, etc

Smart home sensors → Indoor activities, ….

Dynamometer → Grip strength

AR Serious Game → Cognitive state and Behaviour, Physiological state, Motor state

Impedance scale → Body Weight / Body Mass Index

Blood pressure monitor → Blood pressure

Mobil-o-graph → Arterial stiffness

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FrailSafe Conceptual Philosophy

BiG DATA

Older Person

Guidelines

Virtual Patient Model (VPM)

Monitors
Designs Interventions
(adjusts drugs/drug
dosage, makes lifestyle
recommendations)

Clinician
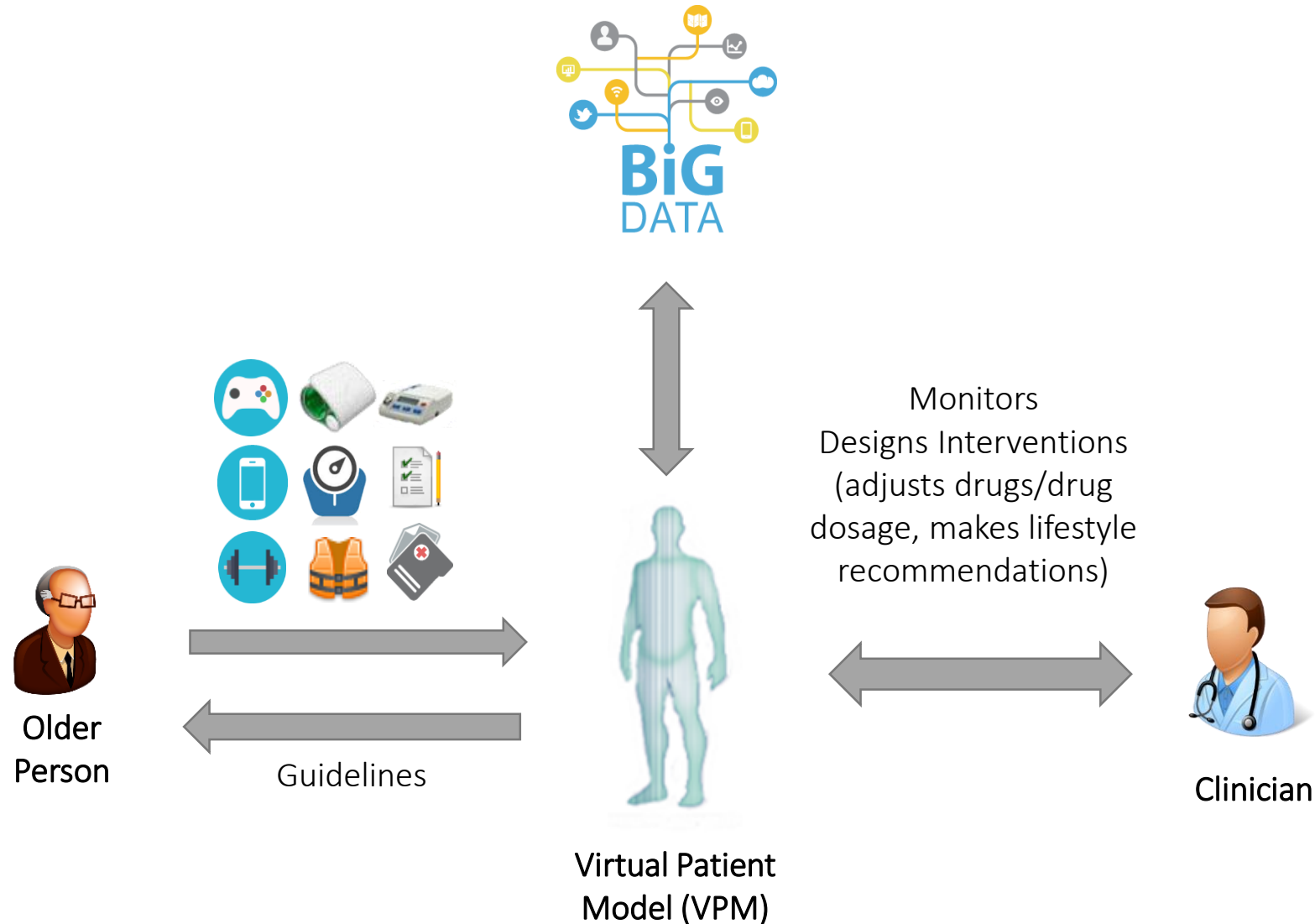
Data Acquisition and Management

Data Aggregation

APACHE HBASE

openEHR VPM

Data Analysis

Multi-sensor data acquisition

GPS | WWBS | Games

Mobilograph | BP Monitor

Impedance Scale | Beacons

Clinical Assessment

400+ participants (aged 70+)
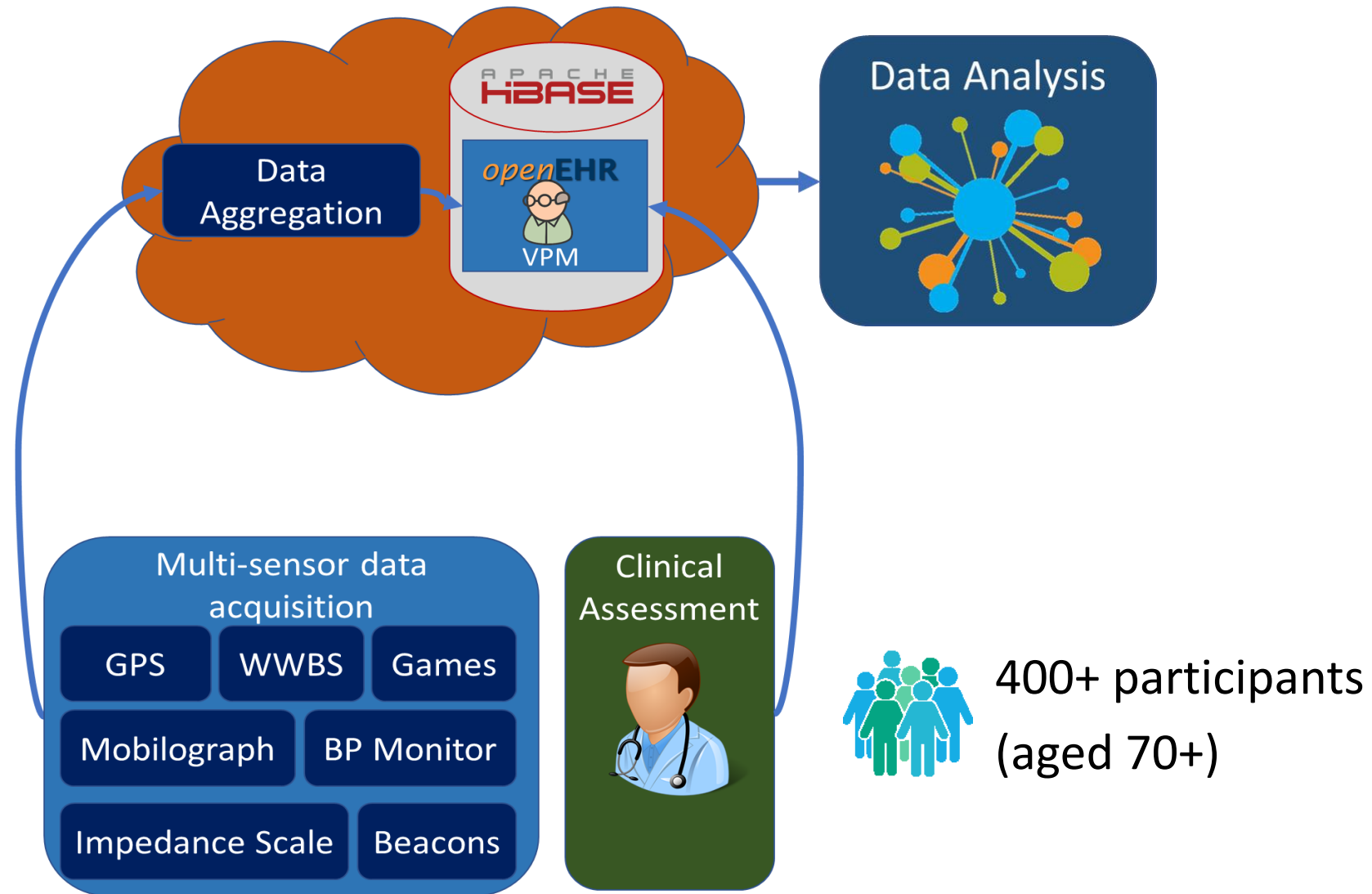
Big Data Analytics
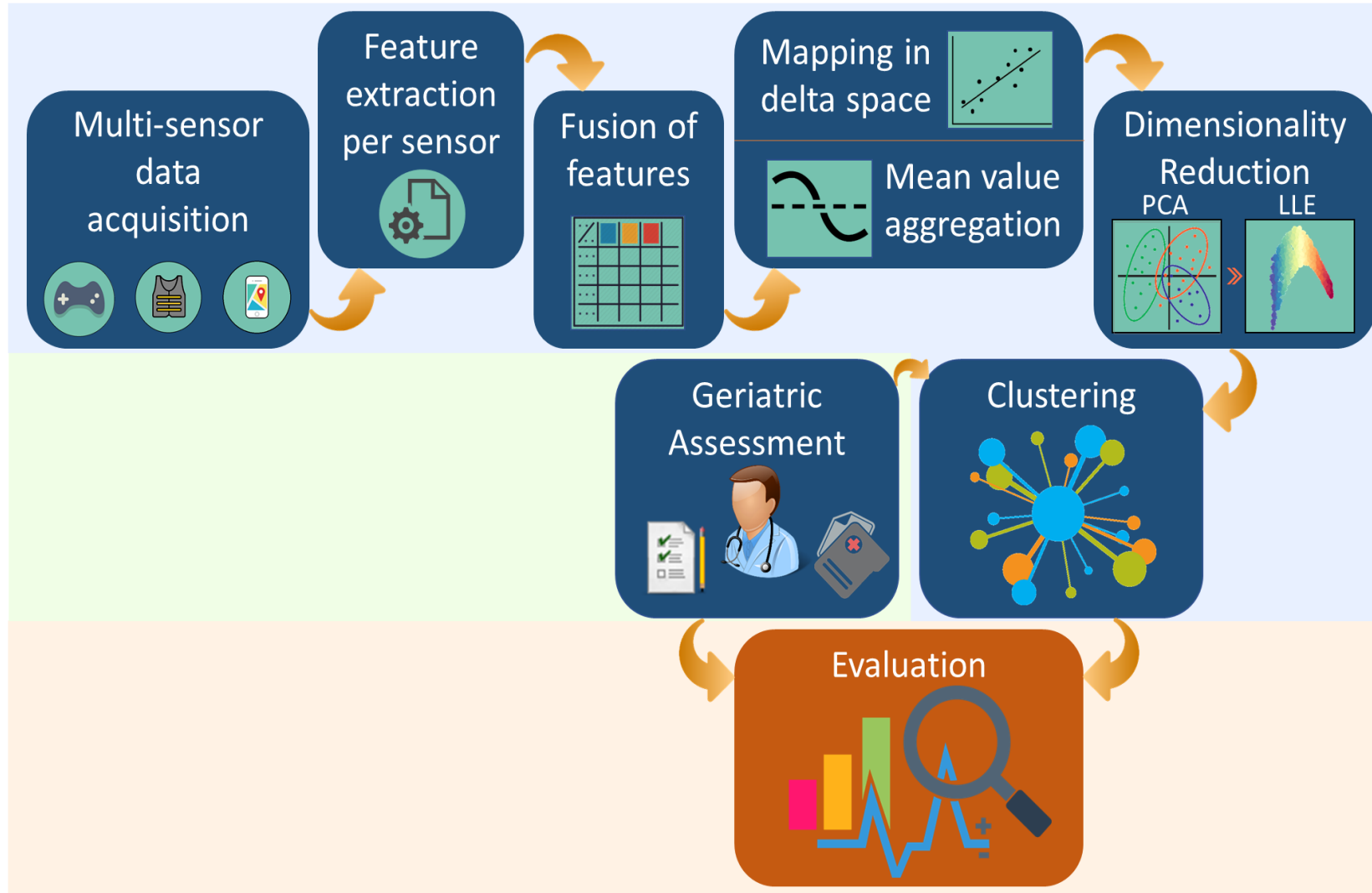
Decision support and alerts generation

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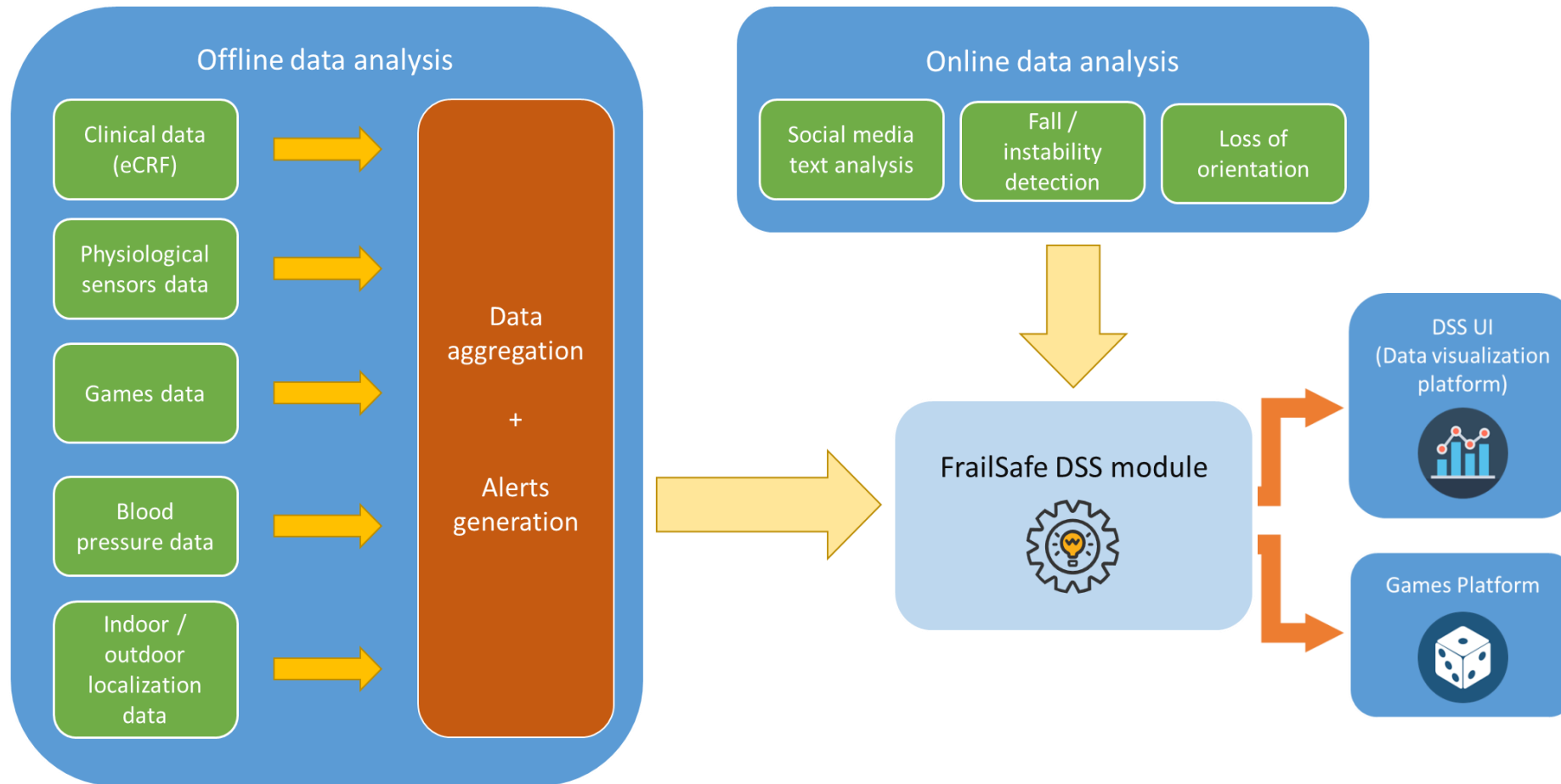
Data Management

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ICT assisted vs Conventional Assessment

- **Assessment in natural environment** than in usual clinical settings

- **Multiple signals in real time conditions** than single shot evaluation

- **Big data analytics** than analysis of limited data

- Objectivity than subjectivity in the interpretation of results

- **Quantitative** than just qualitative

- Transforming traditional to digital model (**explore and use available digital technologies**)

- **Earlier identification of conditions** make feasible early interventions to prevent worsening

- From reactive medicine to proactive/preventive medicine and precision medicine

Prediction of adverse events
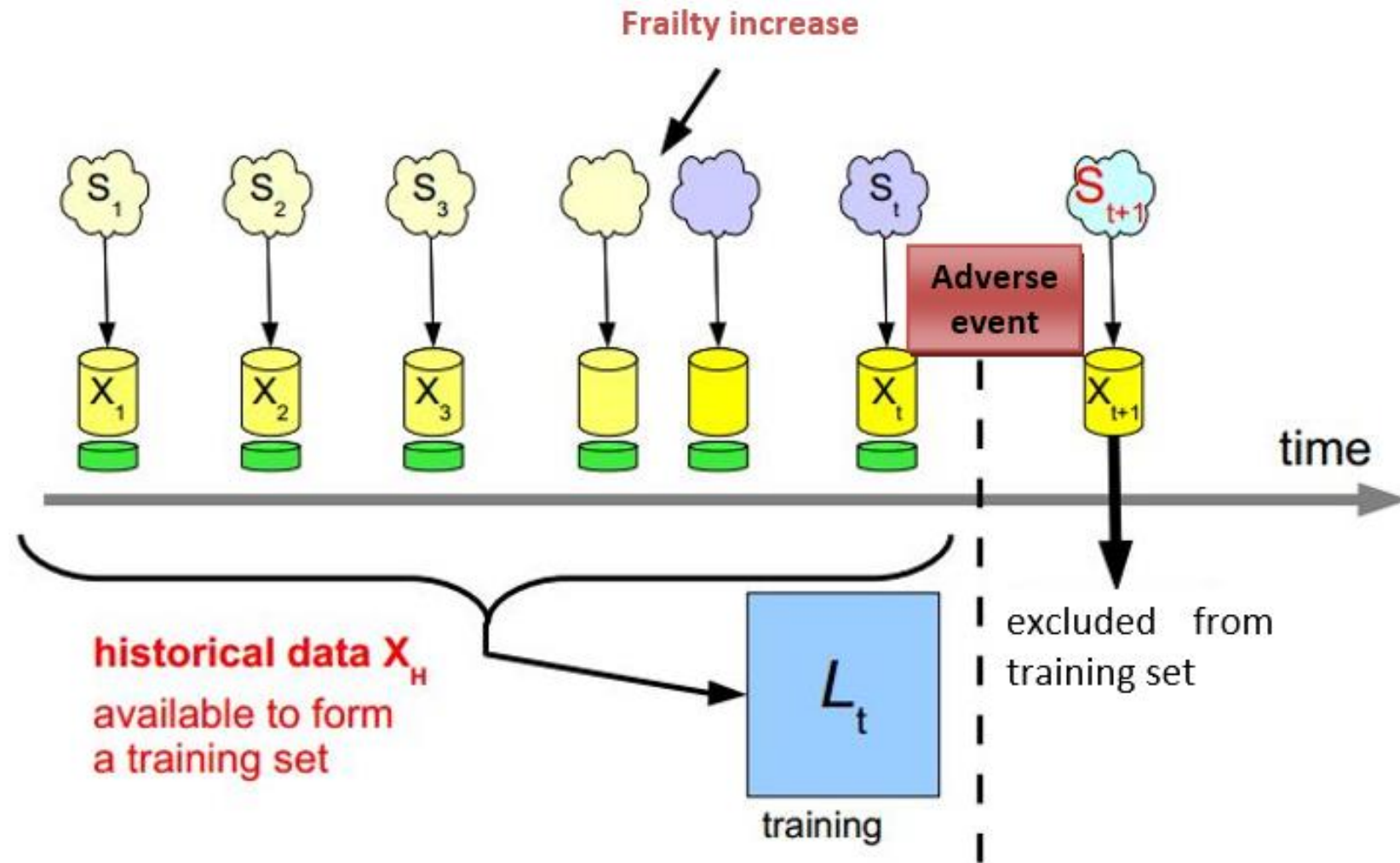
Results: Prediction of adverse events

➢ Multiple Instance Learning
➢ Selection of results based on: AUC>0.6 and BAC>=0.64 for features combinations and compared always against clinical and Fried only

Raw features	AUC	Acc.	Balanced Acc. (BAC)
All (FS+clinical)	0.68	0.69	0.65
All (FS+clinical) no GPS or no Games	0.68-0.69	0.69-0.70	0.64-0.65
Clinical	0.60	0.70	0.63
Fried	0.65	0.70	0.57

| Delta features	AUC	Acc.	Balanced Acc. (BAC)
All (FS+clinical), no GPS	0.71	0.69	0.68
WWSX+Games	0.68	0.71	0.69
Clinical	0.29	0.47	0.39
Fried	0.46	0.61	0.47

Interventions

- **Serious games**:
  - dynamically synthesized and adapted to the specific individual
  - challenging physical, cognitive, psychological, functional and social domains.

- **Recommendations** using advanced HCI conversational agents regarding: lifestyle, daily activity, exercise, nutrition, etc.

- **Assistance** to comply with medical recommendations

- **Adjustment** of drugs or drug dosage by the physician based on the objectively measured parameters

mobile and augmented reality games
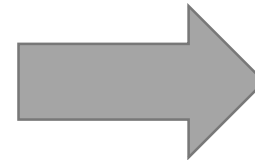
- Activity ↑
- Walking ↑
- Total energy
   expenditure ↑
- Muscle strength ↑
- Posture ↑
- Exhaustion ↓
- Balance ↑
- Falls/injuries ↓
- Cognitive state ↑
- Depression ↓