

# ePHoRt Project

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**A telerehabilitation system for reeducation after hip replacement surgery : Overview and Issues**

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Wednesday, July 5, Porto

# Outlines

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- Justification
- Description of hip replacement surgery
- Main & specific tasks
- Overview of the platform architecture
- Server architecture
- Platform functionalities
- Database modeling
- Movement assessment module

# Justification

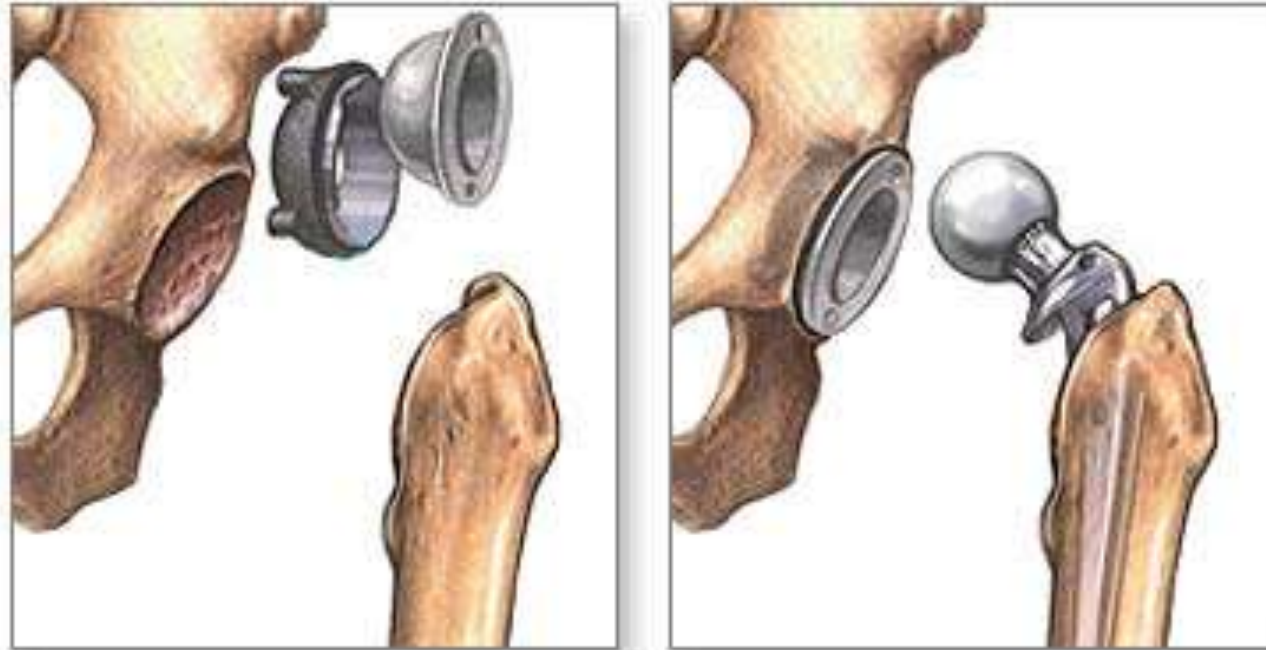
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- ↗ of the average age of the population => ↗ healthcare
- Ubiquitous computing network => ↗ telemedicine & telerehabilitation
- Potential advantages of the telerehabilitation:
  - ↗ the number of (remote) physiotherapy sessions
  - ↘ the patient's transportation from and to the hospital
  - ↗ the empowerment of the patients
  - ↘ of the costs
  - **Overall, it should reduce the recovery time**

# Description of hip replacement surgery

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A metal ball and stem are inserted in the femur and a plastic socket is placed in the enlarged pelvis cup



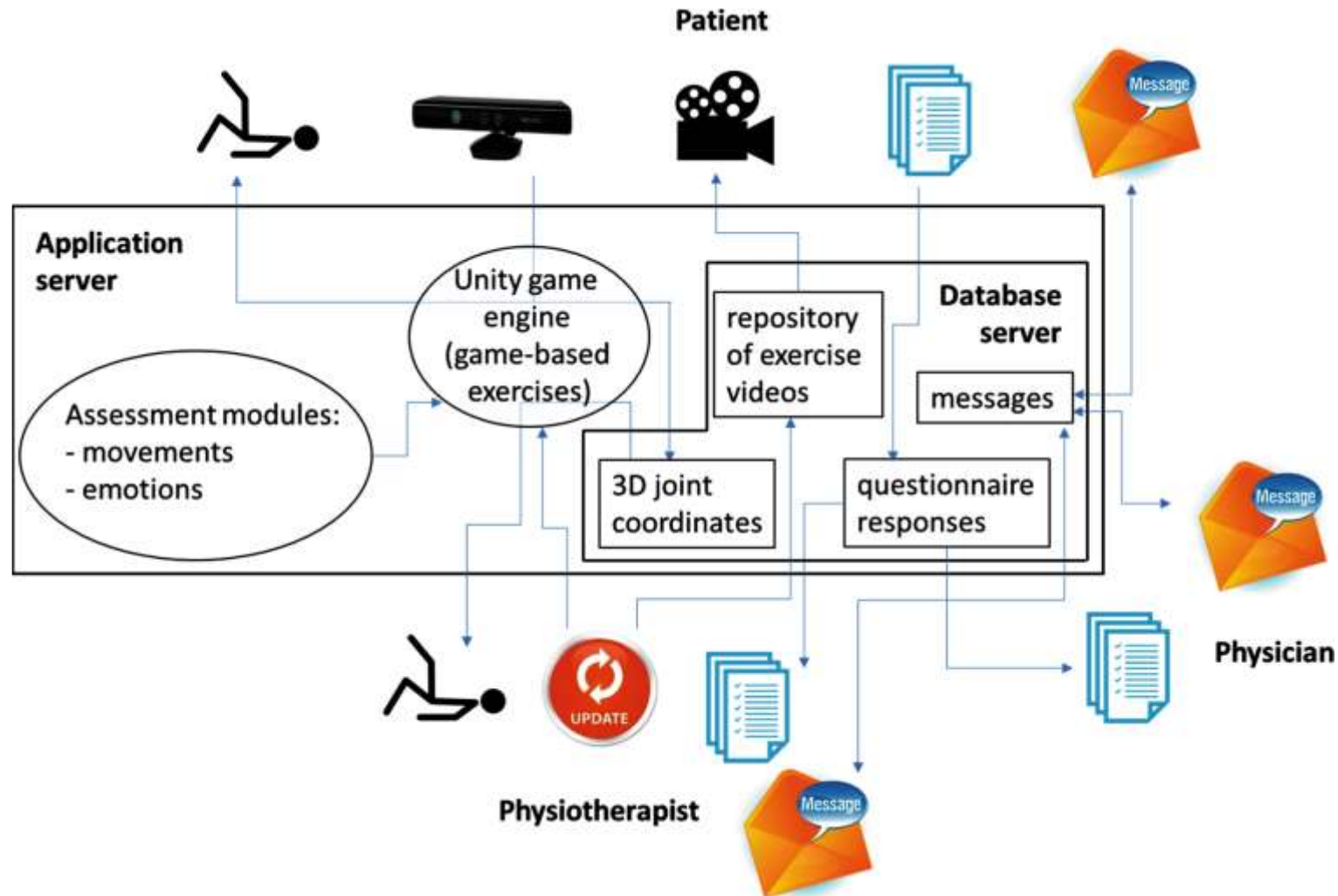
# Main & specific tasks

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- **Develop a web-based system for remote monitoring of home rehabilitation, in order to enhance recovery in patients after hip replacement**
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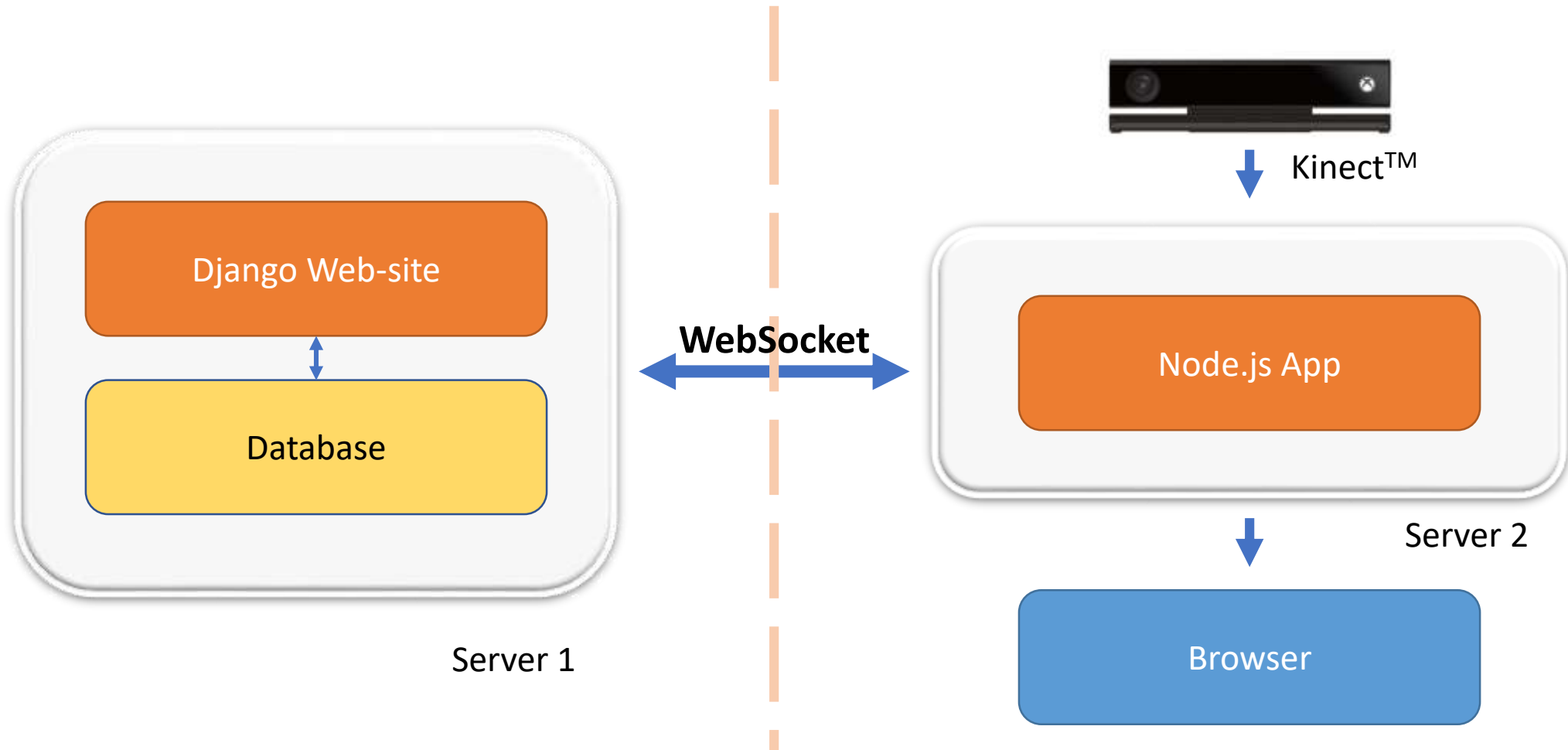
- Sub-tasks:
  - Design of the rehabilitation exercises
  - Implementation of the Web-based application
  - Real time assessment of the correctness of the movements
  - Ergonomic evaluation of the tool

# Overview of the platform architecture



# Server architecture

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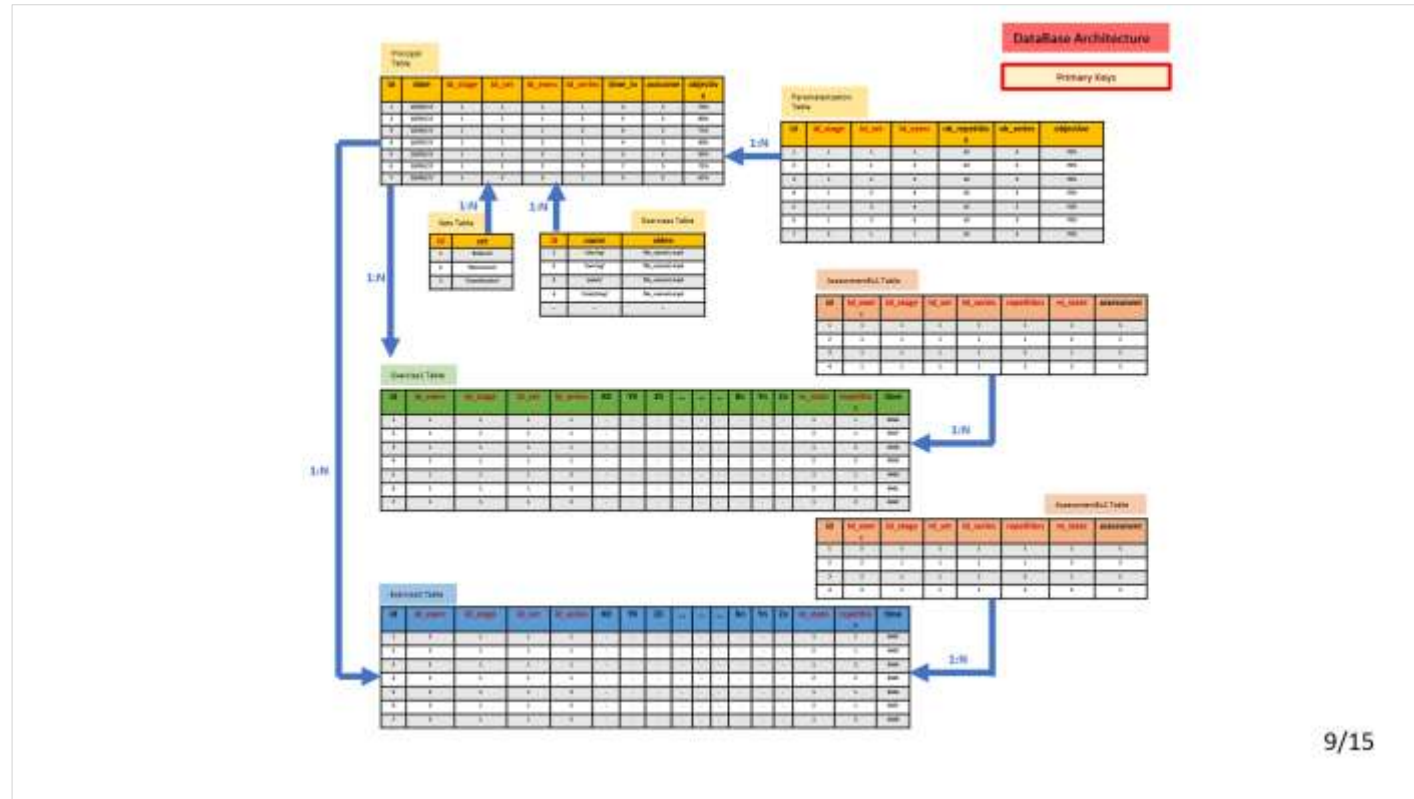
# Functionalities of the platform

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- Login/Logout
- See/Change personal information in User and Physiotherapist interface
- Create a new patient/physiotherapist
- Messaging system
- Display progress/advancement
- Physiotherapist control on exercises/patient's progress



# Database modeling



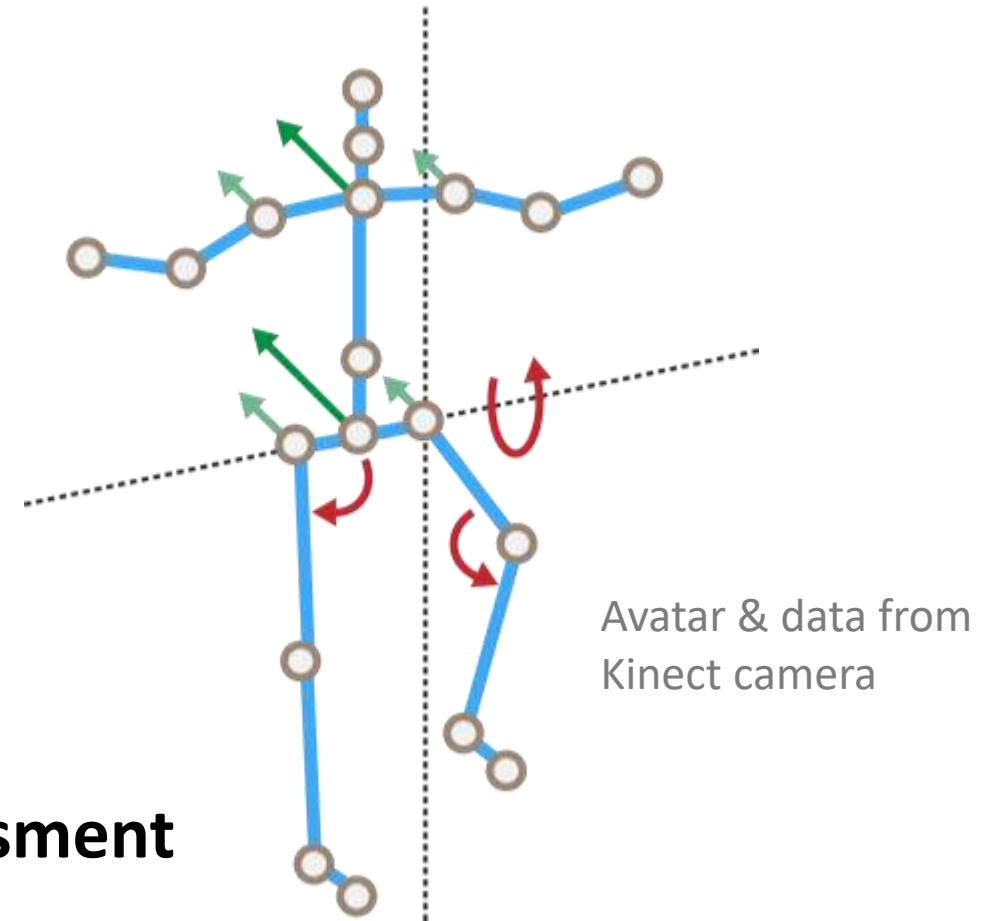
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# Features & Assessment

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- Speeds of core
  - Relative speeds of:
    - Hips and shoulder (measure rotation)
- Angles of hips and knee
  - in sagittal and frontal plane (hips)
- Speeds of Angular change
  - Hips and knees

**18 features in total to calculate the assessment**



# Data

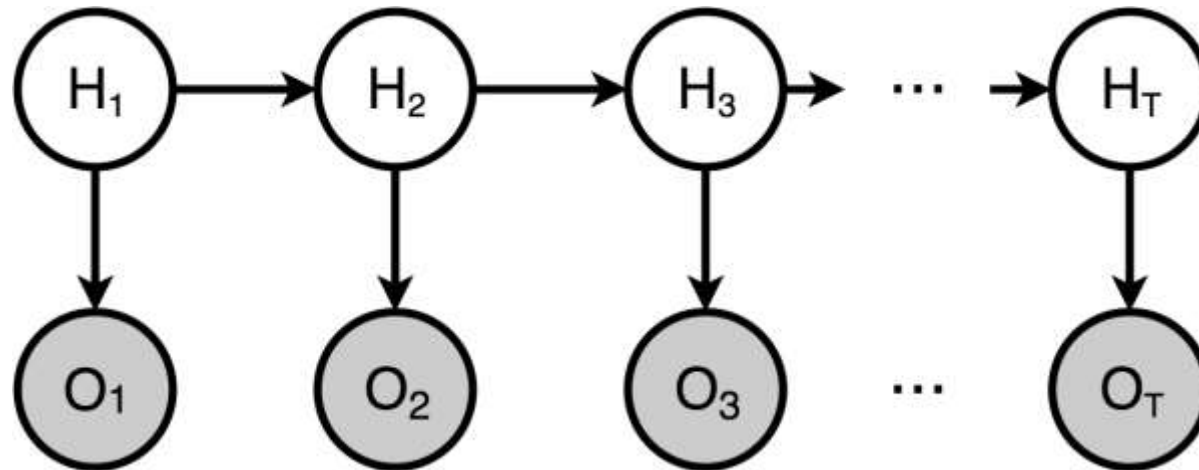
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- Data of 5 exercises performed by 9 individuals
- 8 repetitions per individual per exercise
- Data is labelled by therapist
- Label values are:
  - Perfect, Good and Bad
- Each exercise has 4 labels:
  - Range of motion (ROM)
  - Coordination
  - Compensation
  - Force

# Model

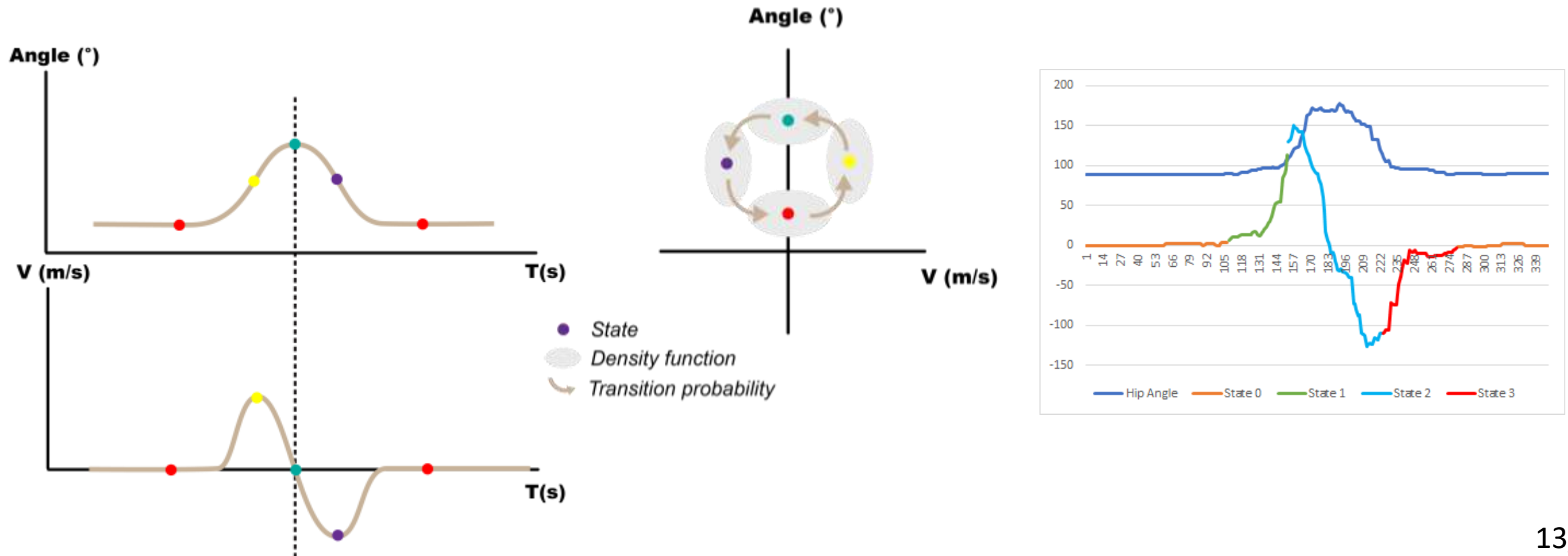
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- Hidden Markov Model
- $O$  represent feature values and  $H$  an associated abstracted state
- $O$  are in fact samples from a distribution function of a state  $H$



# Model Example

- Emission probabilities, Transition probabilities, Initial probabilities



# Our team

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- Yves Rybarczyk, PhD. (Nova University of Lisbon, Portugal; Universidad de Las Américas, Ecuador)
- Danilo Esparza, PhD. (Universidad de Las Américas, Ecuador)
- João Rosas, PhD. (Nova University of Lisbon, Portugal)
- Arían Aladro, MSc. (Pontificia Universidad Católica del Ecuador)
- Jan Kleine Deters (University of Twente, The Netherlands)
- Clément Cointe (Me) (Ecole Normale Supérieure, France)
- Tiago Gonçalves (Portugal)
- Vitor Minhoto (Portugal)

# DataBase Architecture

Primary Keys

