MOTOR FUNCTION AS BIOMARKER
MOTION ANALYSIS FOR THERAPEUTIC INTERVENTION

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MEDICAL ASSESSMENT TODAY

Medical Assessment

Procedures to evaluate medical state, e.g. history-taking, physical examination

Biomarker

Description of health status by using a scale or easy calculation rule

Objective, quantifiable, reproducible characteristic of a biological process

Medical Rating Scales and Scores

Strimbu, Tavel (2011) “What are biomarkers?”
APPLICATION FIELDS AND COOPERATIONS:

Gait Analysis  Vojta Therapy  Parkinson and Balance  Function-Oriented Music Therapy (FMT)

FMT THERAPY
Function-Oriented Music Therapy
Patient plays different drum setups in a given sequence (Codes), which shall activate different areas of his brain (lateral motor function, balance)

→ For patients with injuries or diseases affecting the CNS

DATA ACQUISITION

▪ Field study with 10 patients (5x Stroke, 5x Parkinson’s disease)
▪ 5 - 15 sessions per patient, 20-30 Min. per session
▪ Recording of motion data in 2 treatment rooms via Kinect v1 (mounted to ceiling)
FMT DATA ACQUISITION

RGB Data of selected patients in Code 7 in different treatment sessions

FMT DATA ACQUISITION

Skeletal data (upper body) of all selected patients
FMT DATA ACQUISITION

Skeletal data (upper body) of all selected patients, color-coded by disease

TRAJECTORIES

Trajectory: Motion path in space

Right hand
Left hand

1 drum cycle of 1 proband
1 spatially transformed drum cycle of 1 proband
Trajectories

10 drum cycles of 1 proband

10 spatially transformed drum cycles of 1 proband

Translation of Motion Data to Biomarkers

Requirements

Which measurable biological characteristics ...  
- are detectable and have an effect on health?  
- have low variance to be reliable predictors for a disease?  
- correlate with FMT medical rating scale?

Technical Challenges

1. sparse amount of motion data of disabled persons and belonging medical assessments  
2. robustness against varying recording conditions  
3. understanding of “healthy” and “disabled” motion
Dataset healthy probands:
- 12 persons (10 rh., 2 lh.)
- Drumming in given speed
- 3 variations
  - Increasing distance of cymbals to drum
  - same drum sticks
- Skeletal data, RGB images

Dataset cymbal variations:
- 1 person (rh.)
- Drumming in given speed
- 159 variations of
  - Positions and rotations of cymbals
  - 2 kinds of drum sticks
  - tapping
- Skeletal, RGB, infrared, depth

Dataset healthy probands (select.):
- 10 probands with 1 trajectory set each

Dataset cymbal variations (select.):
- 1 proband, trajectory sets of 60 setups
TRAJECTORY CLOUDS

Healthy

Proband 22,
1 session

Proband 7,
4 sessions

Stroke

Proband 18,
4 sessions

Parkinson

THANK YOU FOR YOUR ATTENTION!
QUESTIONS?

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