The Mobilize Center: Accelerating Movement Science with Big Data

A National Institutes of Health Big Data to Knowledge Center at Stanford University led by Prof. Scott Delp

Eni Halilaj, PhD
Department of Bioengineering
Stanford University
Mobility is essential for human health

Decreased physical activity is linked to heart disease, stroke, diabetes, depression, and obesity.
High-fidelity data are siloed

High-fidelity motion data from experiments and simulations are siloed in research labs and clinics.
Movement data are abundant and growing

New Opportunity: Commercial devices that track movement biomechanics in the wild
The Mobilize Center

Our mission is to overcome the data science challenges facing biomechanics big data to improve human movement across the wide range of conditions that limit mobility.
Discovering insights to improve mobility

1. Motivating Physical Activity at a Global Scale

2. Integrating Multimodal Data to Improve Rehabilitation

3. Treatment Planning with Biomechanics & Data Science
Large-scale data on worldwide activity inequality

Nature, July 2017

2M users from 100+ countries

Tim Althoff  Rok Sosic  Jen Hicks  Abby King  Scott Delp  Jure Leskovec
Activity inequality linked to obesity
Activity inequality linked to life expectancy

Women live longer than men, but a larger gender gap in activity shrinks this difference.
Activity inequality and the environment

Insight from large-scale movement data can inform public policy and urban planning
Optimizing activity habits to prevent osteoarthritis

Physical Activity

Baseline knee MRI  4-year follow-up

20 pre-arthritic men, aged 45-60, BMI of 25 to 27 kg/m²
Optimizing activity habits to prevent osteoarthritis
Optimizing activity habits to prevent osteoarthritis
Optimizing activity habits to prevent osteoarthritis

- Tibia
- Femur

![Graph showing the relationship between activity index and cartilage microstructure index.](chart)

- Improved
- Worsened

- Activity Intensity Range:
  - Sedentary
  - Micro
  - Light
  - Light-mod
  - Moderate
  - Vigorous

- Chart indicates a correlation coefficient $r = 0.96$, $p = 0.04$.
Optimizing activity habits to prevent osteoarthritis

Models based on large data can inform the design of app-based activity modification interventions.
Mobilize Center: Learn More

mobilize.stanford.edu

Revolutionizing mobility research through innovative data science methods

Advancing Data Science

Stanford University’s leading data science and biomedical researchers will tackle key bottlenecks in big data integration and analytics for biomedical research. Learn more.

Impacting Health

Analysis of movement data from wearable sensors, smartphones, clinics, and research labs will help improve human movement across a wide range of conditions. Learn more.

Sharing Resources

The Mobilize Center will engage the biomedical and data science communities by sharing software and data and providing extensive training opportunities. Learn more.
NIPS 2017: Learning to Run Challenge

**Task:** Build a robust controller using deep reinforcement learning

**Goal:** Bridge the machine learning and biomechanics communities

www.crowdai.org/challenges/nips-2017-learning-to-run

Questions? Contact **Lukasz Kidzinski, PhD**
lukasz.kidzinski@stanford.edu
Acknowledgements

Funded by NIH Grants P2C HD065690, U54 GM072970, U54 EB020405