KING'S College LONDON

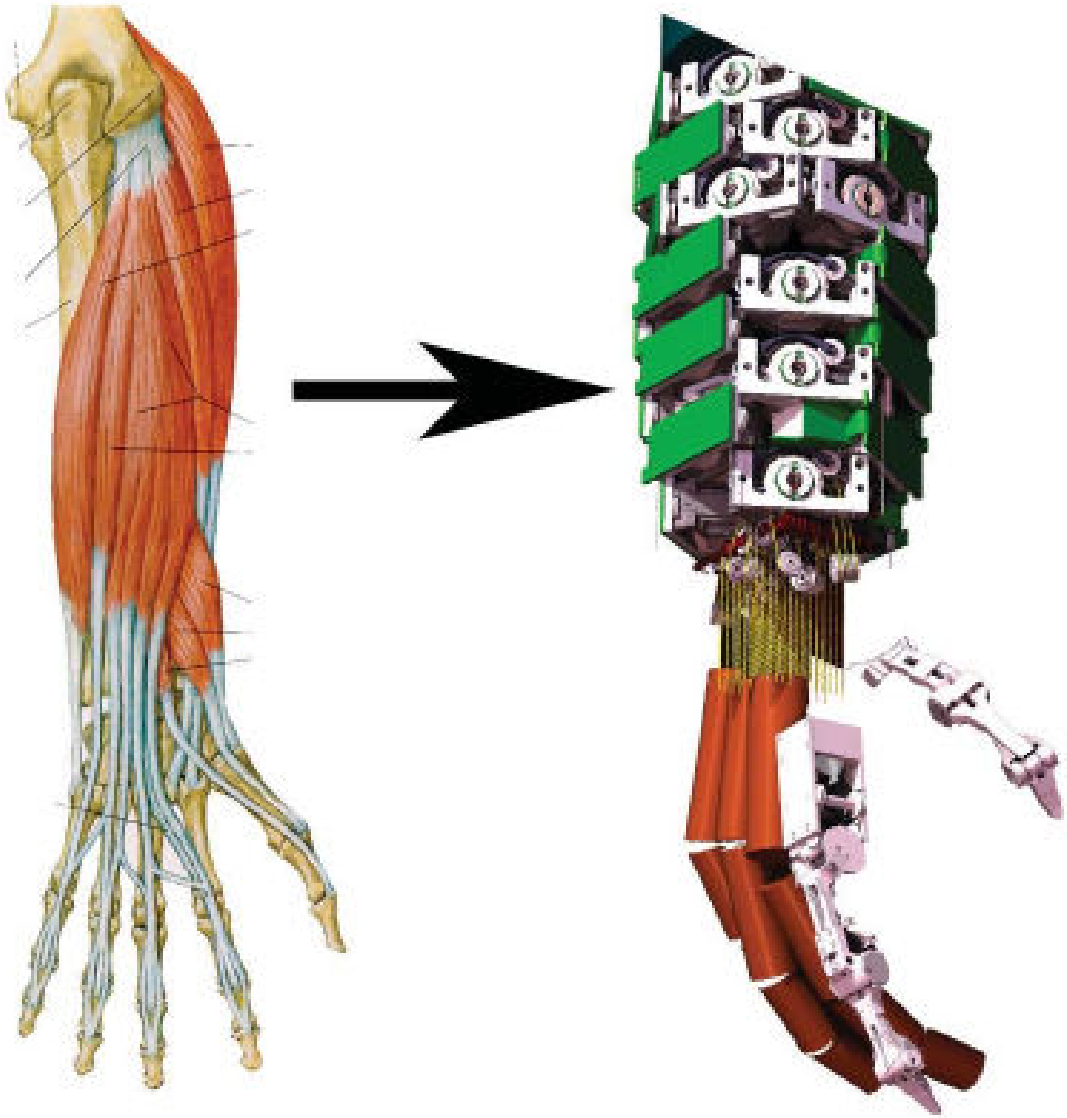
Tailoring Machine Learning to Textile-embedded Sensors

Matthew Howard

July 23, 2018

KING'S College LONDON

matthew.j.howard@kcl.ac.uk · nms.kcl.ac.uk/matthew.j.howard · @mhoward3210



Robot Learning Lab

- Human behaviour modelling, extraction, understanding.
- Imitation learning, programming by demonstration.
- Optimal feedback control, reinforcement learning.
- Humanoid robotics, variable impedance actuation.
- Natural interfaces for capturing human behaviour.

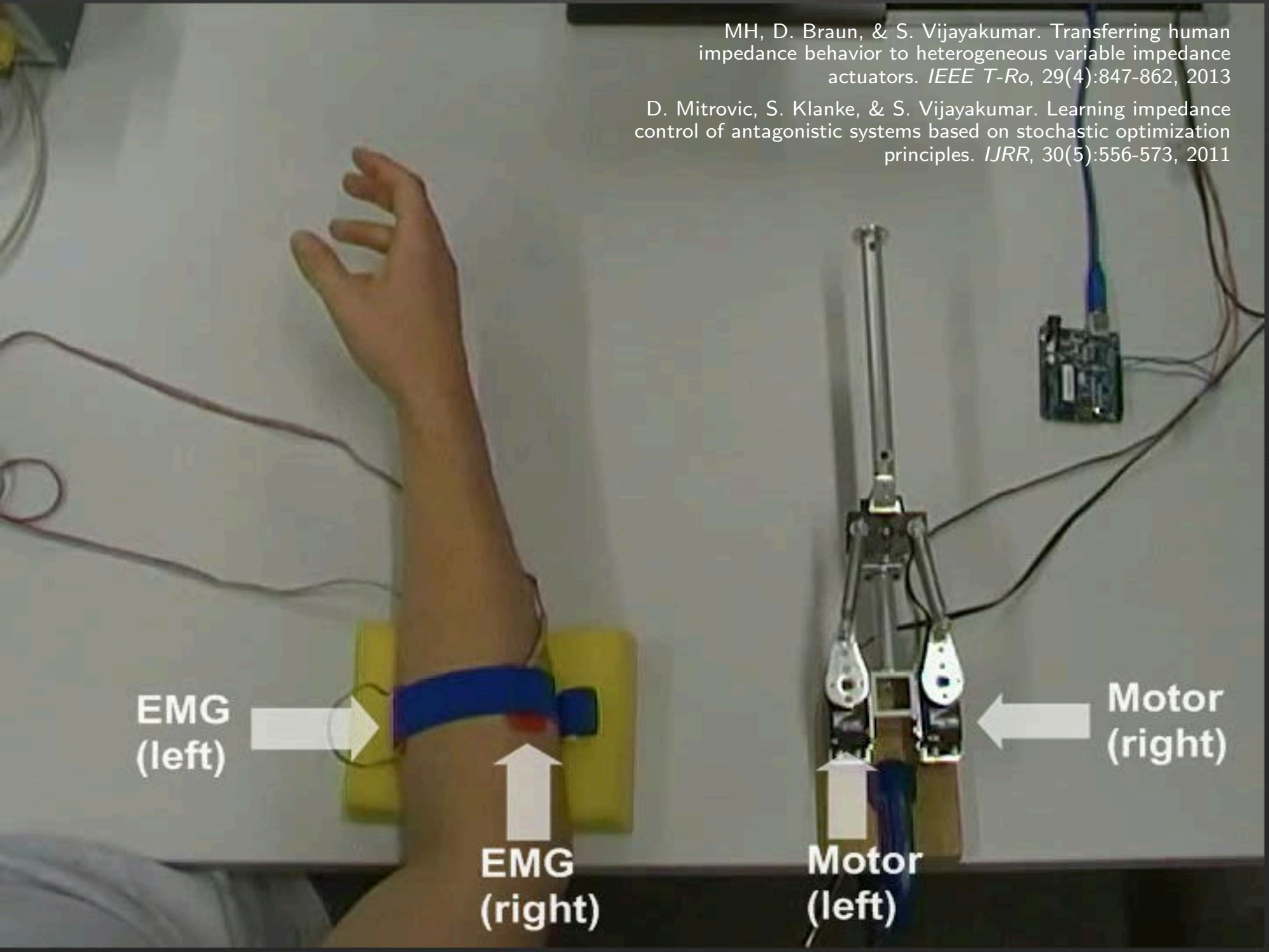
matthew.j.howard@kcl.ac.uk · www.inf.kcl.ac.uk/staff/mhoward · @mhoward3210

KING'S College LONDON

Robots? ... Textiles?

matthew.j.howard@kcl.ac.uk · nms.kcl.ac.uk/matthew.j.howard · @mhoward3210

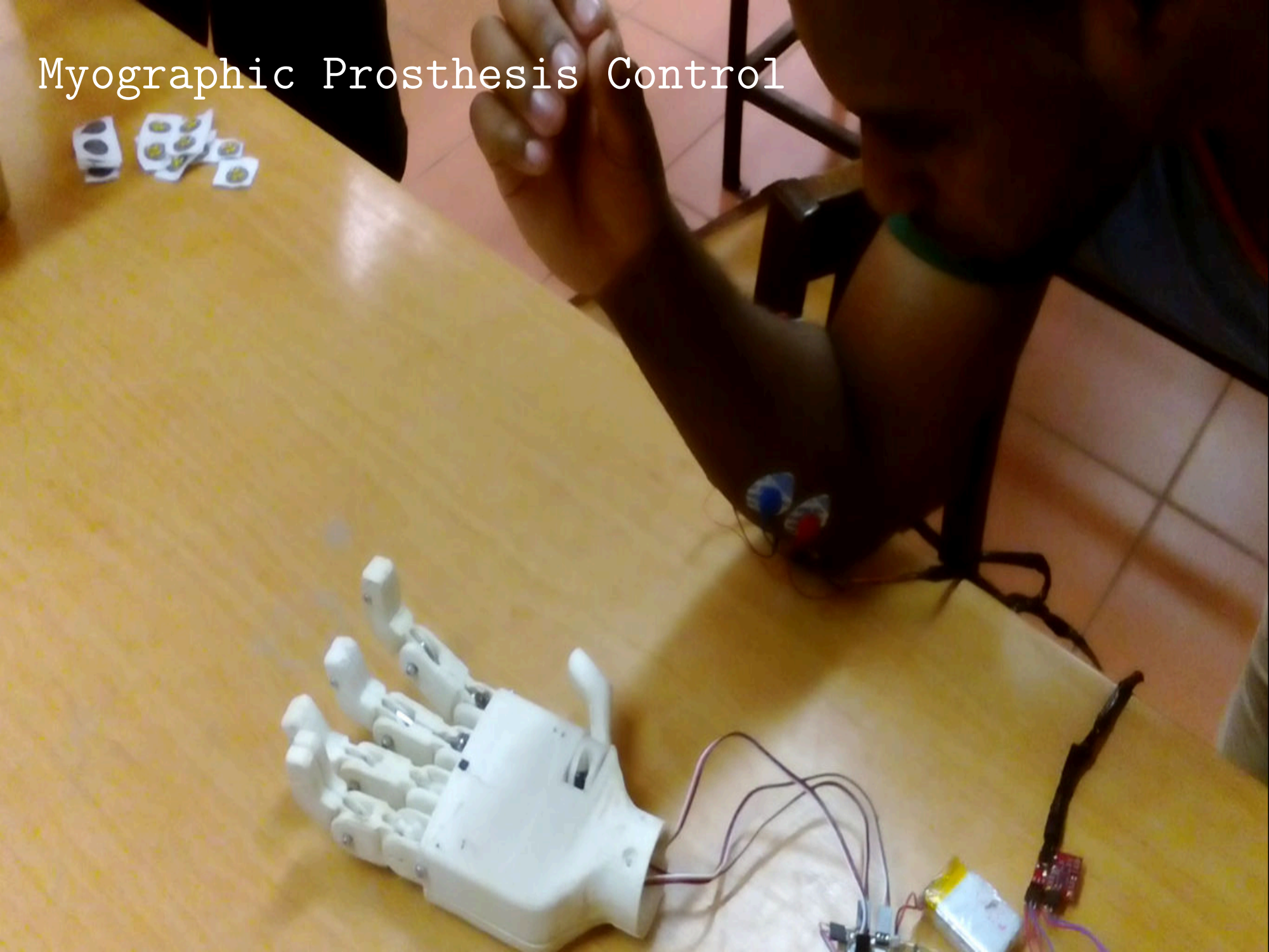

Programming by Demonstration



MH, D. Braun, & S. Vijayakumar. Transferring human impedance behavior to heterogeneous variable impedance actuators. *IEEE T-Ro*, 29(4):847-862, 2013

D. Mitrovic, S. Klanke, & S. Vijayakumar. Learning impedance control of antagonistic systems based on stochastic optimization principles. *IJRR*, 30(5):556-573, 2011

Myographic Prosthesis Control

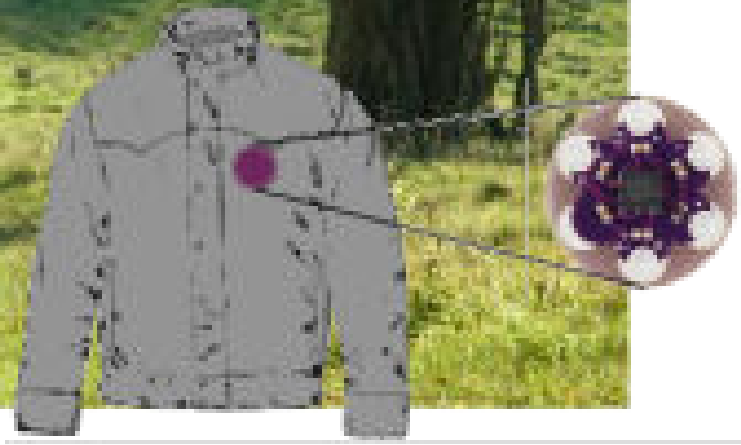


Measuring natural motion

R. B. R. Manero, et al. Wearable embroidered muscle activity sensing device for the human upper leg. *EMBC* 2016,
D. Roetenberg, H. Luinge, & P. Slycke. Xsens mvn: full 6dof human motion tracking using miniature inertial sensors. Tech. rep., Xsens Motion Technologies, 2009, L. Buechley & M. Eisenberg. The lilypad arduino: Toward wearable engineering for everyone. *IEEE Pervasive*, 7:12-15, 2008

matthew.j.howard@kcl.ac.uk · nms.kcl.ac.uk/matthew.j.howard · @mhoward3210

Measuring natural motion

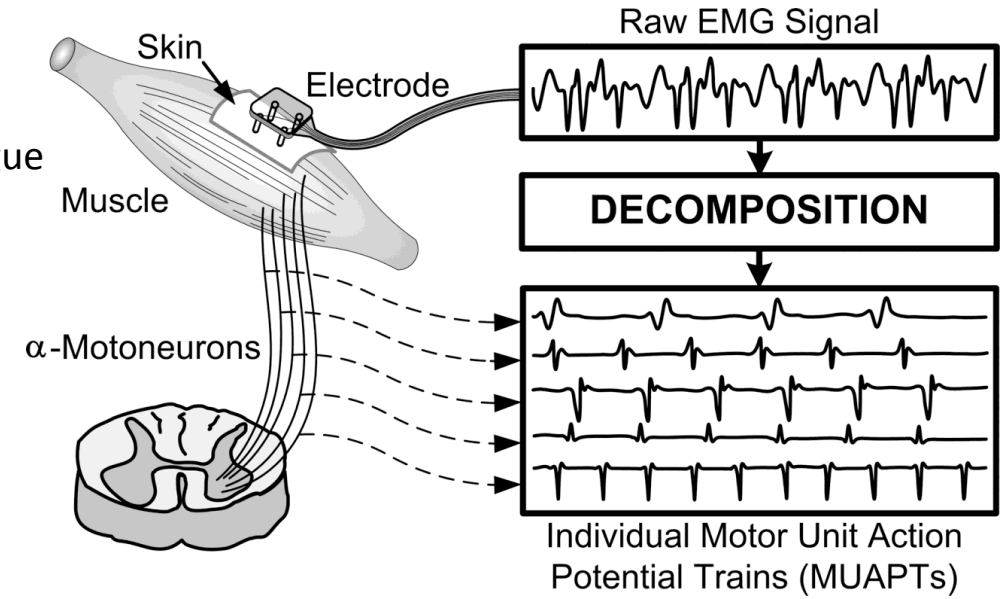


matthew.j.howard@kcl.ac.uk · nms.kcl.ac.uk/matthew.j.howard · @mhoward3210

Measuring natural motion

Surface Electromyography (sEMG)
- Non-invasive but obtrusive
- Allows monitoring of muscle activity, effort and fatigue
- Applications in

  - Gait monitoring
  - Effort assessment
  - Robotic prosthetics
  - Human-robot interaction
  - Ergonomics and comfort assessments



C.J. De Luca et. al "*Decomposition of Surface EMG Signals*", J Neurophysiol, 2006.

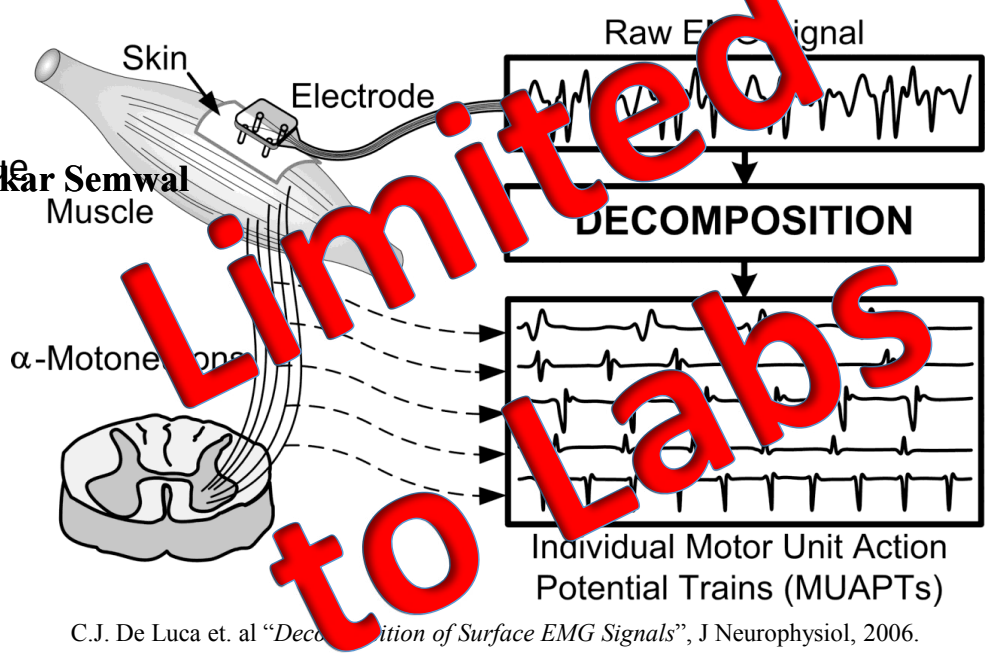
matthew.j.howard@kcl.ac.uk · nms.kcl.ac.uk/matthew.j.howard · @mhoward3210

Measuring natural motion

Surface Electromyography (sEMG)
- Non-invasive but obtrusive
- Allows monitoring of muscle activity, effort and fatigue
- Applications in
  - Gait monitoring
  - Effort assessment
  - Robotic prosthetics
  - Human-robot interaction
  - Ergonomics and comfort assessments

OBTRUSIVE

Limited to Labs



C.J. De Luca et. al "*Decomposition of Surface EMG Signals*", J Neurophysiol, 2006.

matthew.j.howard@kcl.ac.uk · nms.kcl.ac.uk/matthew.j.howard · @mhoward3210

Muscles, Getting a Stitch!

Karina Thompson
Matthew Howard

KING'S College LONDON

CRAFTS COUNCIL