

Kugler, Patrick



I am a researcher in the Digital Sports Group at the Pattern Recognition Lab at the University of Erlangen-Nuremberg, Germany. In my research I focus on the mobile analysis of human motion. This includes studies with wearable sensors, modeling and simulation of human motion, new analysis algorithms for physiological and inertial signals as well as the research of embedded pattern recognition algorithms. More information about me and my current projects can be found at my [lab homepage](#).

Regarding OpenSIM I am currently most interested in realizing predictive simulations using open loop optimal control.

Predictive Simulation of Running and Other Sports Using Optimal Control

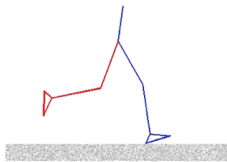


1. Tell us about you:

- Patrick Kugler, University of Erlangen-Nuremberg, Germany
- Ton van der Bogert, Cleveland State University, Ohio, USA
- Heiko Schlarb, a.i.t. innovation team, adidas AG, Germany
- Bjoern M. Eskofier, University of Erlangen-Nuremberg, Germany

2. Big Picture Motivation:

- Predict the influence of *external factors* on human motion
- Currently: extend existing 2D open-loop optimal control model to 3D



$$\arg \min_{\mathbf{x}(t), \mathbf{u}(t)} \mathcal{F}(\mathbf{x}(t), \mathbf{u}(t)) \quad (\text{cost})$$

$$\mathbf{f}(\mathbf{x}, \dot{\mathbf{x}}, \mathbf{u}) = \mathbf{0} \quad (\text{dynamics})$$

$$0 \leq \mathbf{u} \leq 1 \quad (\text{bounds})$$

$$\mathbf{x}(T) = \mathbf{x}(0) + vT\hat{\mathbf{x}}_1 \quad (\text{task})$$

solved via direct collocation



3. Workshop Goal:

- Create a working 3D visualization for our MATLAB software
- Include midfoot kinematics using previously recorded data
- Integrate better with OpenSIM using the C++ or Java interface

OpenSim Workshop August 2013



Here are the slides and videos from my final presentation:

- [KuglerPatrick_Final.ppt](#)
- [running.avi](#)
- [jumping.avi](#)
- [jumping2.avi](#)
- [uturn.avi](#)

Thanks again to the workshop organizers, the OpenSIM team and all participants!

If you have questions or just want to stay in touch, just drop me an e-mail at patrick.kugler@cs.fau.de