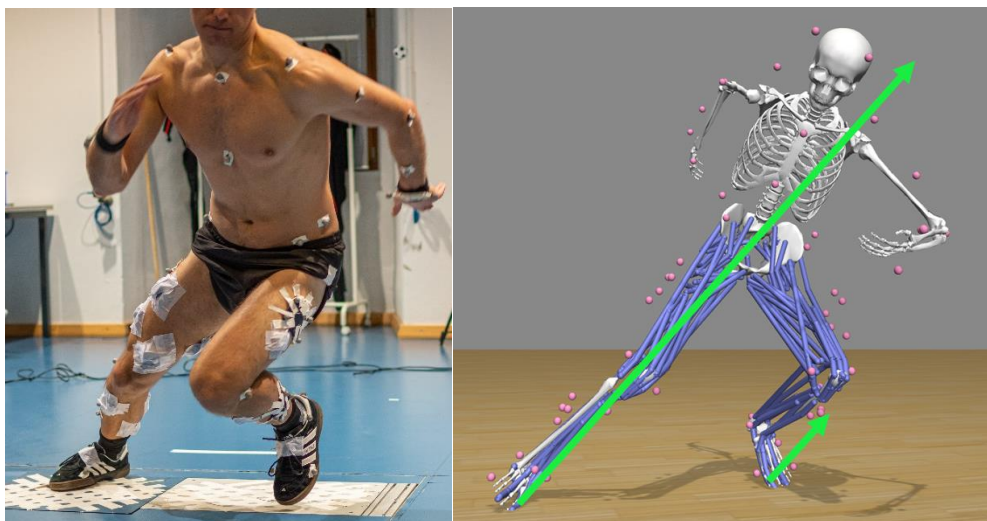**Want to combine engineering & programming skills with your interest in sports?**

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Title: Estimation of muscle forces during high-intensity change-of-direction movements with a focus on knee injury prevention.

Research area: Intersection of sports biomechanics, motor control & computer science

Brief background: Change-of-direction (COD) movements are a frequent source of anterior cruciate ligament (ACL) injuries in sports such as football, rugby, or basketball. Given that at least half of ACL injuries in those sports occur without physical contact to another player, there is the assumption that many non-contact ACL injuries could be prevented if the neuromuscular system of the athletes is trained appropriately. Over the last years, we have investigated how COD movements can be influenced by neuromuscular training programs. However, it would be of interest how such training programs influence the control of movement, which is determined by the forces produced by the individual muscles of the legs. These forces ultimately determine the internal forces that act on the joint soft tissues such as the ACL and provide insight into ACL injury risk and prevention strategies. The challenge is that muscle forces cannot be measured directly but need to be estimated through musculoskeletal models and movement simulation.

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Research goal: To develop a framework for the estimation of muscle forces during high-intensity COD movements based on movement data, muscle activity data, and ground reaction forces. To apply the framework to existing data and investigate how neuromuscular training influences leg muscle forces during COD movements.

Specific objectives for your thesis:

- Develop computational framework for estimation of muscles forces during COD movements using MATLAB and OpenSim software
- Test the integration of CEINMS toolbox (Pizzolato et al. 2015)
- Investigate training effects on leg muscle forces based on existing data
- *Optional:* lead or contribute to scientific publication

What is expected of you?

- Spent 4-6 months at the Department of Sport Science in Innsbruck to work on your master thesis (supervisor at your home university needed!)
- Have (at least some) training in engineering, physics and/or math
- Experience with programming in MATLAB
- Strong interest to apply your skills to questions in sport science

What we offer?

- Be part of a collaborative project between the Department of Sport Science in Innsbruck & the Department Elektrotechnik-Elektronik-Informationstechnik at the University of Erlangen (Prof. Anne Koelewijn)
- Enjoy flexible working hours in the midst of the Tyrolean Alps
- Gain experience in biomechanics, motor control & movement simulation
- Develop your writing & presentation skills in an active research group
- Unpaid internship; however, we are happy to support an ERASMUS+ application.

Project advisor: Ass. Prof. Maurice Mohr (maurice.mohr@uibk.ac.at)

Project duration: 4-6 months, project start to be discussed