Research Statement

DATA-DRIVEN ATHLETE MONITORING & MACHINE LEARNING FOR FATIGUE AND INJURY PREDICTION

Sajjad Habibi Ehsani — BSc Sport Sciences, University of Tehran

MOTIVATION

Modern elite sport generates more athlete data than coaches can reasonably interpret — heart-rate variability, sleep, RPE, GPS load, wellness questionnaires, hormonal markers — and yet the gap between this raw signal and a useful, actionable prediction of fatigue or injury risk remains stubbornly wide. The problem is rarely the algorithm. It is that most ML work in sports science is done either by data scientists who do not have access to elite athletes, or by sport scientists who do not have the methodological depth to model the data well. My ambition is to sit in the middle of those two worlds and produce work that is both technically sound and practically deployable. I am unusually well-positioned to do this because I have already built and shipped a real system at that intersection.

WHAT I BRING

I sit at the intersection of three things that rarely come together in one person: applied sport-science training, hands-on production ML engineering, and direct longitudinal access to elite combat athletes.

Production ML experience. I currently work full-time as Algorithm Architect at Moneli Automation, a digital health company whose recovery platform is deployed to real users. Working directly under Dr. Esmalifalak, I architected the bio-adaptive nutrition algorithms that form the core logic of the platform — the Python and scikit-learn pipelines that translate users' real-time physiological data into individualised, load-responsive nutrition and recovery protocols. I am not someone who has read about applied sport-science ML; I have built it, shipped it, and seen what breaks when it meets a real population of users. That experience has taught me the limits of my own training as much as it has built my confidence: I can ship a working system, but I cannot yet design the controlled experiments needed to validate, refine, or generalise it. That methodological gap is what I want to close in a doctoral programme.

Sport-science foundation. My undergraduate training at the University of Tehran (GPA 17.28/20, departmental rank 1) was in sport science, with a strong applied physiology and biomechanics core. As a research assistant on a neuromechanical injury project (2023–2024), I applied regression models to identify predictors of soft-tissue injury from training-load and athlete-history data,

and I am currently completing a review article on the interaction between hormones, mental fatigue, and injury in elite athletes.

Athlete access. I am a national-team wrestler and Brazilian jiu-jitsu competitor for Iran, and I have spent the past three years coaching elite combat athletes — including World and Asian medallists — alongside Iran's Olympic wrestling head coach. The athletes I coach are exactly the population that academic data scientists cannot easily reach. Any model I help build in a doctoral programme could be tested on real athletes, in real training camps, with real injury outcomes — not on a public dataset.

RESEARCH DIRECTION

In a doctoral programme I would extend this work along three connected lines:

1. **Multimodal injury-risk prediction in elite athletes.** Combining wearable signals (HR, HRV, sleep), self-reported wellness, and training-load data into ML models that predict soft-tissue and overuse injury — and, critically, models that communicate their own uncertainty so coaches know when not to trust them.

2. **Transfer learning and small-sample methods for elite-sport data.** Elite cohorts are tiny by ML standards. I want to use transfer learning from larger sub-elite datasets, synthetic data, and small-sample methods built around the practical reality of elite sport.

3. **Closing the loop with practitioners.** Building lightweight, interpretable interfaces that translate model output into something a strength-and-conditioning coach can actually use, and validating those tools in the field — not just on held-out data.

LONG-TERM GOAL

To build a research career at the intersection of applied high-performance sport and sports data science — producing models and tools that are rigorous enough to publish and practical enough that the coaches I came from will actually use them. Doctoral training is the bridge between the applied side I already know and the methodological depth I need to do this properly.