Peng Yuxuan

Graduate Student in Biomechanics

Beijing, China

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Personal Statement

- Master's student in Biomechanics with clinical medicine background
- Proficient in multiple programming languages, biomechanical analysis software, achieved excellent results in national programming competitions
- Extensive experience in sports equipment testing projects
- Passionate about wearable technology, data analysis, and AI applications in elderly, multiple sclerosis, and disabled populations

Education

2023 - Present | **Beijing Sport University**, 211
Master of Sports Biomechanics

2017 - 2022 | **Jilin University**, 985
Bachelor of Clinical Medicine

Research Experience

2025 - Present | **Effects of Knee Support Equipment on Biomechanical Parameters in Post-ACLR and Healthy Populations**
Principal Investigator, Industry Collaboration Project, Li-Ning Sports Goods Co., Ltd.
• Research objective: Compare and evaluate the biomechanical effects of Li-Ning and competitor knee braces on post-ACLR patients
• Key findings: Knee braces do not alter Y-balance performance in post-ACLR patients but enhance movement confidence, with comfort ratings positively correlated with confidence enhancement

2024 - 2025 | **Application of Nonlinear Dynamic Analysis in Quantifying Running Movement Deviation - A State Space Reconstruction and Pattern Recognition Approach**
Principal Investigator, University Research Innovation Project, Beijing Sport University
• Research objective: Develop nonlinear dynamics-based movement deviation quantification methods to distinguish movement patterns between patellofemoral pain syndrome (PFP) patients and healthy controls
• Key findings: Correlation dimension and sample entropy showed significant statistical differences between patient and healthy groups. Clustering algorithm grouping results significantly correlated with disease grouping, suggesting movement pattern variations in PFP patients

2023 - 2025 | **Validation of Habitual Movement Path (HMP) Theory - A Study Based on Movement Variability and Initial Value Sensitivity**
Principal Investigator, Master's Thesis Project, Beijing Sport University
• Research objective: Validate HMP deviation indicators and hypotheses based on potential contradictions between HMP theory and optimal feedback control theory
• Key findings: HMP deviation indicators showed low test-retest reliability and initial value sensitivity, not reliable clinical indicators. Running trajectory differed from baseline trajectory even under low loads, contradicting HMP theory, suggesting the theory may need reassessment

2023 - 2024 | **Effects of Phase Change Material Cooling Vest on High-Intensity Interval Cycling Training Performance**
Principal Investigator, Industry Collaboration Project, Li-Ning Sports Goods Co., Ltd.
• Research objective: Explore cooling vest application in HIIT cycling to rapidly reduce skin temperature and minimize central inhibition
• Key findings: Cooling vest reduced skin temperature, increased cycling power in latter half of HIIT

and post-cycling vertical jump performance, potentially providing solutions for cycling training in high-temperature environments

2024 - 2025 | **Research on the Effects of Carbon Fiber Plate Running Shoes on Running Economy and Biomechanical Efficiency**
Team Member, Industry Collaboration Project, Li-Ning Sports Goods Co., Ltd.
• Research objective: Evaluate biomechanical effects of carbon plate shoes with different bending stiffness on metatarsophalangeal and ankle joints, and optimization of propulsion efficiency
• Key findings: Established running shoe performance evaluation system, providing scientific basis for high-performance sports equipment design through research on effects of different bending stiffness shoes on running economy and biomechanical parameters

2023 - 2024 | **Comprehensive Biomechanical Performance Assessment of Running Shoe Cushioning Systems**
Team Member, Industry Collaboration Project, FILA Sports Goods Co., Ltd.
• Research objective: Assess lower limb biomechanical effects of support and cushioning road running shoes on PFP patellofemoral joint pain runners
• Key findings: Female runners showed decreased air time, swing time, and stride length after 5km, with reduced vertical ground reaction force peaks; cushioning shoes prolonged ground reaction force loading time in female PFP runners and reduced braking force peaks in male PFP runners; PFP runners showed decreased propulsion force peaks and reduced knee external rotation moments after 5km, suggesting PFP runners may need more stable shoe support

2023 - 2024 | **"Technical and Tactical Evaluation Experimental Technology" Professional Textbook Compilation Project**
Editorial Team Member, Academic Publishing Project,
• Independently authored "Three-Dimensional Force Plate" chapter (17,000 words, including 3 original figures)
• Created force plate comparison table (6 indicators) and Kistler operation manual (with 5 practice questions)

Awards and Honors

2025 | **National AI Application Innovation Competition - National Second Prize**
Chinese Society of Technology Economics
Project integrating large model multimodal capabilities with real-time event recognition technology, achieving integrated intelligent sports viewing agent with semantic parsing, stylized commentary, and personalized interaction

2025 | **National AI Application Innovation Competition - Beijing Special Prize**
Chinese Society of Technology Economics
Same as above.

2024 | **Beijing Sport University First-Class Scholarship**
Beijing Sport University
Recognition for outstanding achievements in academic research and comprehensive performance

2021 | **23rd CUBA Chinese University Basketball League Division II (Northern Region) Championship**
Chinese University Sports Association
Demonstrated excellent teamwork abilities and competitive skills

2016 | **National Olympiad in Informatics for Youths (NOIP) Guangdong Provincial Division - Second Prize**
China Computer Federation
Demonstrated solid foundation in computer science and programming during high school

Publications

1. Peng Yuxuan, Li Hanjun. Effects of Cooling Vest on HIIT Cycling Training and Subsequent Strength Training Performance [C]

2. Xu Meiyuan, Peng Yuxuan, Li Hanjun. Effects of Patellar Support Elastic Compression Knee Guard on Biomechanical Characteristics of Knee Joint in Basketball-Specific Movements [C]

Professional Skills

1. Programming Skills:
   - Proficient: R (tidyverse, duckdb, gt), Python (PyTorch, TensorFlow), C++, Typst
   - Familiar: SQL, MATLAB, LaTeX, JavaScript
2. Biomechanical Software:
   - Proficient: Visual3D, Qualisys, FastMove3D
   - Familiar: OpenSim
3. Large Language Model Applications:
   - Vibe Coding: Cursor, Warp
   - Agent Design: LangGraph, n8n

Personal Statement

Abstract

Research Interest: Feature engineering of wearable device motion data and clinical applications. **Research Experience:** Nonlinear analysis (phase space reconstruction, attractors), habitual movement patterns (optimal feedback control, initial value sensitivity). **Goal:** Become an independent researcher and complete high-quality dissertation.

1 Research Interest

Smart wearable devices hold tremendous market potential for specific populations. Key target users include **people with impaired motor function** (elderly, chronic disease patients, disabled individuals), with applications spanning health management, clinical decision support, and rehabilitation training. Feature engineering is the critical technical component, focusing on establishing effective mapping relationships between sensor data and **health management goals, clinical decisions**.

My research interest focuses on the above-mentioned **feature engineering** and mapping relationship construction.

- Specifically, I aim to apply cutting-edge methods such as **nonlinear analysis and machine learning** to extract valuable feature indicators for health management and clinical decision-making from raw kinematic data collected by wearable devices.
- Combining AI technology to build real-time **health feedback systems** for chronic disease management and condition monitoring is also a research direction that interests me.

Additionally, I am interested in the mechanisms of **abnormal and compensatory movement patterns** caused by diseases.

- With the development of new rehabilitation devices such as exoskeletons and smart prosthetics, understanding abnormal and compensatory movement patterns will become increasingly important.

2 Research Experience

2.1 Nonlinear Analysis Project

Research Purpose: Explore whether nonlinear analysis can be used for motion feature extraction in PFP injured populations

Technical Approach: Dynamic system feature extraction. Model knee joint movement trajectories as chaotic systems, mapping them to high-dimensional state space through phase space reconstruction. Build movement pattern recognition algorithms based on **attractor geometric features** (correlation dimension, sample entropy). Use **cluster analysis** to validate feature extraction effectiveness, successfully distinguishing patellofemoral pain syndrome patients from healthy controls.

Research Conclusions: Some nonlinear analysis indicators (correlation dimension, sample entropy) can be used to distinguish PFP injured populations

Inspiration for future doctoral work:
- Familiarized with nonlinear analysis concepts and code implementation, laying foundation for subsequent doctoral work
- Experienced the potential of new methods, inspiring strong interest in feature engineering exploration

2.2 Habitual Movement Patterns Project

Research Purpose: Evaluate the sensitivity and reliability of movement deviation indicators constructed by Run Signature algorithm in detecting movement pattern changes

Technical Approach: Movement variability analysis under **optimal feedback control** theoretical framework. Use **RS algorithm** to implement movement deviation indicator calculation, conduct test-retest reliability assessment (ICC analysis). Analyze movement variability under optimal feedback control theoretical framework. Validate correlation between initial contact moment and maximum flexion moment during stance phase, proving **initial value sensitivity characteristics**.

Research Conclusions: Existing HMP quantification methods have limitations—variability originates from initial movement states rather than load responses

Inspiration for future doctoral work:
- Dare to question existing methods and propose new analytical frameworks
- Strengthen understanding of movement control system complexity (optimal feedback control theory)

3 Goals

3.1 Short-term Goals (Doctoral Stage)

- Complete a solid dissertation
- Initially become an independent researcher (with own direction and published papers)
- Master new feature engineering methods (nonlinear analysis, machine learning, big data)

3.2 Long-term Goals (Career Planning)

- First choice: University researcher in wearable devices and clinical decision-related research
- Second choice: Industry engineer in wearable device motion data feature engineering applications
- Common goal: Create technical solutions with real value for industry and society

4 Summary

I enjoy the research process of reading papers and exploring data. I am deeply interested in your research in wearable devices and look forward to applying nonlinear analysis and machine learning methods during my doctoral studies.

I look forward to joining your young and vibrant team to advance research progress together, and hope to receive scholarship support.

北京体育大学研究生成绩单

姓名	彭宇轩	性别	男	
层次	硕士（学术型）	专业	运动人体科学	
入学日期	2023年08月27日	学号	2023210274	

课程名称	考核方式	学分	成绩
自然辩证法概论	考查	1	66
研究基础与研究方法	考查	2	68
新时代中国特色社会主义理论与实践	考查	2	86
运动解剖学原理与应用	考查	2	87
运动生理学原理与应用	考试	2	92
运动生物力学原理与应用	考查	2	96
运动生物化学原理与应用	考查	2	85
体育测量评价原理与应用	考试	2	60
体能训练概论	考查	2	90
运动医学原理与应用	考查	2	90
动作学习与控制	考查	2	95
科技论文写作规范与技巧	考查	2	92
运动员科学选材	考查	2	90
组织化学	考查	2	84
运动生物力学研究进展	考查	4	98
科研伦理与学术规范	考试	2	97
如何写好科研论文	考试	2	98
英语（CET6）	考试	4	540
实修学分：39　　平均分：86.71			
说明：A=100-86；B=85-76；C=75-60；D<60。			

核发人签章：_____　　北京体育大学

签发日期：_____　　培养单位盖章处：

吉林大学本科学生成绩单

Undergraduate Academic Transcript of Jilin University

姓 名：彭宇轩　　**身份证号：**440305199906080010　　**学 号：**70171128

学 院：白求恩第二临床医学院　　**年级专业：**2017级临床医学(五年)　　**学 制：**5 年

课程名称	性质	学分	成绩	重修
2017-2018 学年第 1 学期				
大学生心理健康	必修	2.0	99	
大学英语BⅠ	必修	3.0	80	
思想道德修养与法律基础	必修	2.5	88	
形势与政策Ⅰ	必修	1.0	77	
军事理论	必修	1.0	75	
军事训练	必修	3.0	优秀	
体育Ⅰ	必修	1.0	85	
医用数学C	必修	3.0	82	
无机化学B	必修	3.0	80	
无机化学实验B	必修	1.0	92	
影视文化与中国现当代文学（核心课）	选修	2.0	70	
机械学概论（核心课）	选修	2.0	优秀	
2017-2018 学年第 2 学期				
大学生职业发展与就业创业指导Ⅰ	选修	1.0	99	
孙子兵法与企业经营	选修	2.0	优秀	
大学英语BⅡ	必修	3.0	75	
马克思主义基本原理概论	必修	2.5	79	
中国近现代史纲要	必修	2.0	60	
人体解剖学A	必修	5.0	60	
组织学与胚胎学A	必修	5.0	71	
体育Ⅱ	必修	1.0	83	
医用大学物理与实验	必修	4.5	68	
有机化学E	必修	3.0	50	68
有机化学实验D	必修	1.0	83	
在影视里学心理	选修	2.0	96	
2018-2019 学年第 1 学期				
大学英语BⅢ	必修	3.0	77	
毛泽东思想和中国特色社会主义理论体系概论	必修	4.0	88	
生理学A	必修	7.0	72	
生物化学A	必修	7.0	60	
细胞生物学A	限选	3.0	67	
卫生法学A	必修	2.0	78	
体育Ⅲ	必修	1.0	98	
大学计算机基础	必修	3.5	78	
2018-2019 学年第 2 学期				
形势与政策Ⅱ	必修	1.0	94	
病理解剖学A	必修	6.0	61	
病理生理学A	必修	4.0	60	
医学免疫学A	必修	3.0	73	
医学微生物学A	必修	4.0	64	
体育Ⅳ	必修	1.0	97	
数据库及程序设计	必修	3.5	77	
2019-2020 学年第 1 学期				
大学英语BⅣ	必修	3.0	81	
药理学A	必修	5.0	66	
局部解剖学A	必修	5.0	74	
人体寄生虫学A	限选	2.0	60	
医学遗传学A	限选	3.0	68	
分子生物学A	限选	2.0	67	
医学伦理学	必修	1.0	67	
预防医学A	必修	5.0	68	
2019-2020 学年第 2 学期				
超声诊断学	限选	1.0	67	
基础医学专业英语A	限选	3.0	76	
医学信息检索B	必修	1.5	82	
检体诊断学A	必修	4.0	73	
实验诊断学A	必修	3.0	55	64
医学影像学A	必修	4.0	64	
外科总论A	必修	3.0	60	
全科医学	选修	1.5	77.5	
中医学A	限选	3.0	69	
核医学A	限选	2.0	89	
临床基础综合实习	必修	4.0	74	
2020-2021 学年第 1 学期				
内科学A	必修	10.0	60	
外科学A	必修	6.0	72	
妇产科学A	必修	5.0	66	
儿科学A	必修	4.0	56	76
神经病学A	必修	3.0	60	
临床肿瘤学	必修	3.0	80	
临床专业综合实习	必修	7.0	73	
基础医学综合考试	必修	10.0	74	
2020-2021 学年第 2 学期				
法医学	限选	2.0	66	
循证医学	选修	1.0	76	
医学科研导论	选修	2.0	66	
口腔科学A	限选	1.0	60	
临床专业外语A	限选	2.0	63.5	
医学心理学A	限选	1.0	69	
眼科学A	限选	2.0	60	
耳鼻咽喉科学A	限选	2.0	70	
精神病学A	限选	2.0	67	
皮肤病学A	限选	2.0	61	
康复医学A	限选	2.0	66	
重症与急诊医学A	限选	2.0	60	
传染病学A	限选	2.0	64	
大学生职业发展与就业创业指导Ⅱ	选修	1.0	92	
2021-2022 学年第 2 学期				
心电诊断学C	限选	1.0	75	
毕业实习	必修	46.0	68	
课外培养计划	必修	8.0	63.3	
以下空白				

已获总学分：292.5　　学分平均成绩：71.09　　学分平均绩点：1.96

教务处长（签字）：

教务处（盖章）：

终端号：电子成绩单　　制表时间：2023年3月19日　　