# Boce Hu

## CONTACT INFORMATION

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## EDUCATION

**Columbia University**  New York, USA
Master of Science in Mechanical Engineering  Sep 2021 - May 2023 (expected)
Advanced master with a concentration in Robotics and Control, GPA: 3.94/4.00
- Coursework: *Intro to Robotics, Robotics Studio (A+), Evolution Algorithm, Data Science, Robot Learning, Deep Learning (A+), Natural Language Processing, Reinforcement Learning*

**Civil Aviation University of China (CAUC)**  Tianjin, CN
Bachelor of Engineering in Flight Vehicle Power Engineering, GPA: 3.62/4.00  Sep 2016 - Jul 2020
- Coursework: *Aviation Engine Principle, Aviation Engine Control, Aviation Engine Structure, Aviation Engine Emission, Dynamics of Aircraft*

## PUBLICATIONS

Chenfei Zhu, **Boce Hu**, Jiawei Chen, Xupeng Ai, Sunil K. Agrawal, "SARN: Shifted Attention Regression Network for 3D Hand Pose Estimation"
*Bioengineering, Under Review*

**Boce Hu**, Chenfei Zhu, Xupeng Ai, Sunil K. Agrawal, "ACRNet: Attention Cube Regression Network for Multi-view 3D Human Pose Estimation in the Postural Star-sitting Test"
*Scientific Reports, Under Review* [PDF]

Xupeng Ai, Victor Santamaria, Jiawei Chen, **Boce Hu**, Chenfei Zhu, Sunil K. Agrawal, "A Deep-Learning Based Real-Time Prediction of Seated Postural Limits and its Application in Trunk Rehabilitation"
*IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE), Published, 2022* [PDF]

Wenting Lu, Yajun Chen, Xianjie Song, Keyu Wang, **Boce Hu**, Xuntao Zhang, "Study on the Removal Process of Oxide Scale on the 17-4PH Aviation Fasteners"
*PLATING&FINISHING, 2019*

## RESEARCH EXPERIENCE

**Robotics and Rehabilitation (ROAR) Lab**, *Columbia University*  New York, USA
Advisor: Prof. Sunil K. Agrawal  Oct 2021 - Present
- Collected and labeled the depth-image-based upper body movement dataset and hand movement dataset based on the postural star-sitting test and Parkinson's finger tapping test.
- Designed an Attention Cube Regression Network (ACRNet) and a Shifted Attention Regression Network (SARN) to complete body pose estimation and hand pose estimation works.
- Validated the state-of-the-art performance of both networks on public datasets and the potential in real rehabilitation scenarios.
- Developed a new deep-learning-based controller for the trunk support trainer to predict the dynamic virtual motion boundary of upper body movements in real-time.

**Laboratory of Aircraft Structure Strength Test and Corrosion Analysis**, *CAUC*  Tianjin, CN
Advisor: Prof. Yajun Chen  Mar 2018 - Dec 2019
- Created a test device to be jointly used with Instron 8803 fatigue testing system to build a corrosion test platform.
- Built a multi-parameter adjustable electrolytic pickling device, which includes four modules: electrolytic reaction module, liquid level control module, temperature control module, and stirring magnetic module.

## TEACHING

**Teaching Assistant**                                                      Columbia University
Robot Learning                                                                Jan 2023 - Present
- Held weekly office hours.
- Graded the homework.

**Teaching Assistant**                                                      Columbia University
Data Science for Mechanical Systems                                                    Fall 2022
- Provided academic support for students according to course material.
- Graded and provided Q&A for weekly assignments.

## WORKING EXPERIENCE

**Dilato Innovative Technology Limited**                                            Beijing, CN
Software Development Intern, mentored by Xiaoyu Peng                       Dec 2020 - Jun 2021
- Developed and tested functional modules for the Adobe XD project using Java.
- Completed the black-box test to support the latest version to go live.

## SELECTED COURSE PROJECTS

**Visual Information-Based Robotic Arm Grasping Using a Deep Learning Model**          Dec 2022
- Leveraged a deep learning model to predict the robotic arm grasp poses from a depth image scene, which contains a variety of objects at random locations.
- According to the objects' spatial information, the deep learning model can output the grasp position, grasp angle, and gripper width to complete the grasp work. [Code]

**Dynamic Torque Control of Multi-link Robotic Arms According to End Effector Target Positions**          May 2022
Advised by Prof. Matei Ciocarlie
- Controlled the state (i.e., velocity, angle, and torque) of multi-link robotic arms to achieve specific positions.
- Compared the speed of approaching the target position and the ability to maintain the current state after reaching the target position between deep learning and multiple deep reinforcement learning algorithms.
- Leveraged OpenAi Gym, PyTorch, and Stable-Baselines3 to build the real physical working environment and train the model to complete different control tasks.

**Design, Fabrication, and Programming of a Humanoid Robot**                          Dec 2021
Advised by Prof. Hod Lipson
- Designed and fine-tuned the detail of each component of the humanoid two-legged robot's CAD model.
- Fabricated each part of the robot using 3D printing and assembled them with the Raspberry Pi, motors, controller board, *etc.*, as the entire robot.
- Programmed and tested each motor of the robot, allowing our robot to walk and dance stably. [Journey Video]

**Soft Robot Locomotion Training with Evolutionary Algorithm**                          Dec 2021
Advised by Prof. Hod Lipson
- Built an engine to simulate the real-world environment with Python and OpenGL for robot training.
- Treated each soft robot as a parent genotype and iteratively utilized the selection, mutation, and crossover mechanism to evolve the internal state of soft robots to improve the speed of hopping gait.
- Calculated the speed of each robot and used this speed as a reward to optimize the soft robot population.

## AWARDS

- Summer Research Scholarship, **Columbia University**                                  2022
- 2$^{nd}$-Class CAUC People's Scholarship, **CAUC**                              2019, 2020
- 3$^{rd}$-Class CAUC People's Scholarship, **CAUC**                                    2018

## SKILLS

**Programming Languages**: Python, MATLAB, C++, JAVA, Git
**Software:** TensorFlow, PyTorch, OpenCV, Stable-baselines-3, Pybullet, Robot Operating System (ROS), SolidWorks, Blender, Ultimaker Cura (3D-Printing), LaTeX, Linux