

## Chao NI

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### EDUCATION

**ETH Zürich**, Zürich, Switzerland  
*Master of Science In Robotics, System and Control*  
from 2019.9 on

**Peking University**, Beijing, China  
*Bachelor of Science*  
In Theoretical and Applied Mechanics  
College of Engineering, 2015-2019  
*Bachelor of Economics*  
National School of Development, 2016-2019

**Johns Hopkins University**, Baltimore, American  
*Visiting Student, Advised by Gregory Chirikjian, 2018.6-2018.9*  
The Laboratory for Computational Sensing and Robotics

**Tsinghua University**, Beijing, China  
*Research Assistant, Advised by Chongjie Zhang, 2019.1-2019.9*  
The Machine Intelligence Group

### SELECTED COURSES

Mathematical Optimization  
Convex Optimization  
Model Predictive Control  
Linear System Theory  
Advanced Machine Learning

Probabilistic Artificial Intelligence  
Dynamic Programming and Optimal Control  
Robot Dynamics  
Computational Animation for Robots

### RESEARCH INTERESTS

- Legged robots, Trajectory Optimization, Model Predictive Control
- Reinforcement Learning Control

### RESEARCH EXPERIENCE

#### Trajectory Optimization for Wheeled Quadrupedal Robots

**Advisor:** Marko Bjelonic, Ruben Grandia, Marco Hutter 2020.3 -

- Utilized a parameterized method to optimize for the trajectories on tough terrains; automatically switched between rolling and walking mode;
- Guided the robot's motion with the optimized trajectory by using a model predictive control fashion.
- Ongoing, for current progress please check <https://youtu.be/t-CA4kFoTbo>

#### Hexapod Robot Control

**Course Project** 2020.5 - 2020.6

- Developed an inverse kinematic solver for the hexapod robot
- Designed multiple gaits and the transition between for the robot;
- Implemented obstacle avoidance features on tough terrain for the hexapod;
- The project and video can be found at <https://github.com/chaofiber/hexapod>

#### Cooperative Representation Learning with Self-Supervised Synchronization

**Advisor:** Chongjie Zhang **Collaborator:** Guangxiang Zhu 2019.3 - 2019.9

- Proposed Self-supervised Cooperative Network (SCN) utilizing synchronization between images and vectors using contrastive loss;
- Combined our model with PPO and showed that our model outperformed raw images in reinforcement learning problems.

## **Globally Optimal Reparameterization Algorithm-Based Frame Selection for Video Action Recognition**

**Advisor:** Gregory Chirikjian **Collaborator:** Sipu Ruan 2018.6 - 2019.3

- Simulated the temporal fluctuation effect, illustrated the difference between a uniformly distributed video and a video with temporal fluctuation (the video can be found at <https://about.2cni.com/robo.html>);
- Utilized the global optimal reparameterization algorithm (GORA) as a preprocess for frame selection in deep learning architecture;
- Compared the training performance between the GORA based frame selection method, uniform selection and random selection, and verified the advantage of the GORA based frame selection preprocess;
- Verified the outperformance of GORA in various deep learning neural network architectures.

## **Model Predictive Learning Control in Rehabilitation**

**Advisor:** Qining Wang 2018.3 - 2018.9

- Proposed a self-adaptation feature of the assistive exoskeleton in long distance walking because of the uncertainties in the real human walking process;
- Combined the model predictive control and iterative learning control into the same framework, after several walking gaits the uncertainty disappearing;
- Developed the model predictive learning control framework, operated on YALMIP with the MATLAB platform, and verified the control rule by simulation, serving to show the assistive performance would become better and steady.

## **SKILLS**

**Programming:** C++, Python, MATLAB, Fortran, L<sup>A</sup>T<sub>E</sub>X;  
**Deep Learning:** TensorFlow  
**Statistics:** R, STATA, SPSS;  
**Operating System:** Linux.

## **AWARDS**

- Chen Overseas Exchange Scholarship (1%)(Peking University)
- 2017 & 2018 Academic Excellence Awards (5%) (Peking University)
- First Prize for the Mathematical Modeling Contest(Peking University)