

## Chao NI

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### EDUCATION

**ETH Zurich**, Zurich, Switzerland

*Master of Science* In Robotics

from 2019.9 on

**Peking University**, Beijing, China

*Bachelor of Science*

In Theoretical and Applied Mechanics

College of Engineering, 2015-Present

Major GPA: 89 (3.84/4)

2/34

**Johns Hopkins University**, Baltimore, American

*Visiting Student, Advised by Gregory Chirikjian*

The Laboratory for Computational Sensing and Robotics

### SELECTED COURSES

Calculus (I)	91/100	Probability and Mathematical Statistics	93/100
Calculus (II)	88/100	Fluid Mechanics	90/100
Data Structure and Algorithm (H)	86.5/100	Engineering information retrieval & Scientific Writing	95/100
Theoretical Mechanics	89/100	Computational Fluid Dynamics	86/100
Ordinary Differential Equations	94/100	Finite Element Methods	94/100
Electromagnetism	92/100	Entrepreneurship: New Venture Creation	91/100
Mechanics of Materials	87/100	Modern Physics	88.5/100
Advanced Dynamics	92/100	Thermal Physics	89/100
Numerical Analysis	85/100		
Methods of Mathematical Physics	92/100		

### RESEARCH INTERESTS

- Machine learning; Reinforcement learning; Computer vision
- Robotics and Control

### PUBLICATION

- Guangxiang Zhu\*, **Chao Ni**, Hao Cheng, Chongjie Zhang, “Cooperative Representation Learning with Self-Supervised Synchronization”, in process.
- Sipu Ruan\*, **Chao Ni\***, Gregory Chirikjian, “GORA-Net: a Temporal Reparameterization Method for Recognizing Actions in Video Sequences”, to be submitted.

### RESEARCH EXPERIENCE

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

**Advisor:** Chongjie Zhang **Collaborator:** Guangxiang Zhu, Hao Cheng 2019.3

- 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 beated 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 - Present

- 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://nichao.xyz/research.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.

#### **Gradient Descent Method: an Alternative to GORA in Frame Selection**

**Advisor:** Gregory Chirikjian

2018.6 - 2018.8

- Utilized the gradient descent method and its variant RMSprop to compute the temporal reparameterization mapping function;
- Used the bisection method to deduce the approximate value of the mapping function in the sampled points, reducing computation cost;
- Proved that the gradient descent method could be an alternative approach to GORA in videos which were uniformly distributed, and proved that this method could be used as a refinement after the GORA operation.

#### **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.

#### **Assistive Control of Lower Exoskeleton**

**Advisor:** Qining Wang **Collaborator:** Geng Chen

2017.12 - 2018.8

- Used the loop shaping method to raise the natural walking frequency of human lower limb, thus helping with walking performance;
- Put forward a double-pendulum-based model to simulate the dynamics of the lower-limb and deduced the transfer function considering the impedance control;
- Introduced a DC gain feedback controller and a lead controller to shift the frequency curve upwards and rightwards.

#### **COMPETITION** **Kaggle**

PUBG Finish Placement Prediction: 30%

#### **SKILLS**

**Programming:** C/C++, Python, MATLAB, Fortran,  $\text{\LaTeX}$ ;

**Deep Learning:** TensorFlow, Pytorch, Keras;

**Statistics:** R, STATA, SPSS;

**Operating System:** Linux.

#### **AWARDS**

- Chen Overseas Exchange Scholarship (1%)
- National Talent Scholarship (1%)
- Xia & Huan Undergraduate Internship Scholarship (UPOS) (10%)
- 2017 & 2018 Academic Excellence Awards (5%)
- First Prize for the Mathematical Modeling Contest held in PKU
- Second Prize for the National Physics Olympic Competition (10%)