

# YITAO XU

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## EDUCATION

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**M.Sc. Computer Science**, Exchange, École Polytechnique Fédérale de Lausanne, EPFL 2022-Present  
**M.Sc. Machine Learning**, KTH Royal Institute of Technology 2021-Present  
GPA: 5.0/5.0.  
**B.Eng. Computer Science**, Beihang University 2016-2020  
GPA: 90.4/100.

## RESEARCH EXPERIENCE

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**-Research Intern, Image and Visual Representation Lab, EPFL** 06.2022 - Present  
*-Advisor: [Ehsan Pajouheshgar](#), [Prof. Sabine Süsstrunk](#)*

**Topic: Real-time Dynamic Texture Synthesis using Neural Cellular Automata**

- Proposed DyNCA to synthesize dynamic texture videos of arbitrary size and infinite length in real time, while all current SOTA methods can only synthesize a short, fixed-size video in a few hours.
- Devised multi-scale perception and positional encoding to enhance performance of the vanilla NCA on texture learning.
- DyNCA can synthesize more realistic texture videos than current methods, as shown by an extensive user study on 150 persons, each required to assess the realism of nearly 60 videos.
- Built an [interactive demo](#), providing many real-time interaction tools with DyNCA.

**-Research Assistant, Tsinghua Laboratory of Brain and Intelligence, Tsinghua University** 11.2020 - 05.2021  
*-Advisor: [Prof. Jia Liu](#)*

**Topic: Towards Machines Understanding Physics: Block Tower Stability Inference**

- Developed the algorithm to make machines infer the stability of block towers like humans using shape-bias-enhanced CNN.
- Demonstrated the consistency of DNN and humans at the computational level of probabilistic judgments of block-tower stability, through an extensive user study on more than 50 people and 100 block towers.
- Developed a [platform](#) for physical event simulation.

**-Research Intern, State Key Laboratory of Software Development Environment, Beihang University** 04.2019 - 05.2020  
*-Advisor: [Prof. Xianglong Liu](#)*

**Topic 1: Interpreting Convolutional Neural Networks (CNN) with Neuron Sensitivity**

- Proposed a new method for interpreting various popular CNN via analyzing sensitive neurons by segmenting the input images, and proved their criticalness for CNN via neuron ablation study.
- Developed a new method to train robust CNN against adversarial attacks by stabilizing sensitive neurons, achieving SOTA defense performance against adversarial attacks.

**Topic 2: Adversarial Attack against the Agent in Embodied Question Answering**

- Developed the [algorithm](#) to perform adversarial attacks against the embodied agent, with SOTA attacking performance.
- Proposed spatially contextual attack and helped develop temporal attention method to improve the attacking efficiency.

**Topic 3: Analysis and Rectification of Texture Bias in Convolutional Neural Networks**

- Analyzed texture and shape bias in CNN and validate the texture bias of trained CNN.
- Proposed the algorithm to obtain shape-related and texture-related feature maps inside a CNN via distorting the shape or texture of the input images.
- Proposed the new loss function to enhance the shape bias of a CNN via minimizing the cosine distance between shape-related feature maps and the original ones, improving the SOTA adversarial training methods.

## PUBLICATIONS

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## PUBLISHED

- Chongzhi Zhang, Aishan Liu, Xianglong Liu, **Yitao Xu**, et al. (2020). Interpreting and improving adversarial robustness of deep neural networks with neuron sensitivity. *IEEE Transactions on Image Processing*, 30, 1291-1304.
- Aishan Liu, Tairan Huang, Xianglong Liu, **Yitao Xu**, et al. (2020, August). Spatiotemporal attacks for embodied agents. In *European Conference on Computer Vision* (pp. 122-138). Springer, Cham.
- Tianlin Li, Aishan Liu, Xianglong Liu, **Yitao Xu**, et al. (2021). Understanding adversarial robustness via critical attacking route. *Information Sciences*, 547, 568-578.

## PREPRINT

- Ehsan Pajouheshgar\*, **Yitao Xu**\*, Tong Zhang, and Sabine Süssstrunk. DyNCA: Real-time Dynamic Texture Synthesis Using Neural Cellular Automata. arXiv preprint arXiv:2211.11417, 2022.

\*: Equal contribution.

## WORK EXPERIENCE

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**-Machine Learning Intern, DiDi AI Labs, DiDi Global Inc.**

06.2020 - 11.2020

-Group Leader: *Dr. Zhengping Che, Prof. Jian Tang*

### Project 1: Embedded Real-time UAV Pedestrian Detection

- Developed an interpolation-based framework for pedestrian detection in 2K UAV videos using EfficientDet in TensorRT.
- The proposed method works 3 times faster than the vanilla EfficientDet on a real-world dataset without losing performance (84.4 mAP and  $\sim 10$  FPS on Nvidia Jetson TX2 platform). [Patent](#) granted.

### Project 2: 3D LiDAR Point Cloud Object Detection on nuScenes Dataset

- Used Gaussian pyramid and multi-model fusion to boost the performance of 3d LiDAR object detection. Ranked 1/42 on [nuScenes detection leaderboard](#), team PVC-ensemble, 09/12/2020.

## HONOURS AND AWARDS

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- **Outstanding Undergraduate** of Beihang University, 11.2019
- **Outstanding Undergraduate** of Beihang University, 11.2018
- **Outstanding Undergraduate** of Beihang University, 11.2017
- **Scholarship for Academic Merit**, Beihang University, 09.2016

## TEACHING

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**-Department of Psychology, Tsinghua University**

Course: **Advances in Cognitive Science**

02.2021 - 05.2021

- Gave a 2-hour lecture on the development of Symbolism, based on chapter 3.2-3.4 in “Mind, body, world: foundations of cognitive science”. [slides](#).

## VOLUNTEERING

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**-Volunteer tutor for junior students** at Beihang University.

09.2017 - 06.2018

Mentor junior students on core courses, including “Principles of Computer Organization”, “Algorithmic Design and Analysis”, “Probability and Statistics”.