

# Peng YIN

## Project Scientist

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My name is Peng Yin, a Project Scientist in the Robotics Institute of Carnegie Mellon University. Currently, I am working in the AirLab guided by professor Sebastian Scherer. My research focus includes : SLAM, Visual Localization, 3D Perception, Reinforcement Learning and Incremental Learning. The aim of my research is to help robots to achieve centimeter visual localization in challenging indoor/outdoor environments, and long-term autonomy. And I also works as the perception lead for CMU Darpa Subterranean Challenge, and we got No.1 at 2019, and No.2 at 2020.

## 🎓 FORMATION

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2020.6-2022.8	Carnegie Mellon University, USA, Project Scientist.
2019.3-2020.6	Carnegie Mellon University, USA, Post Doctoral Fellowship.
2017.9-2019.3	Carnegie Mellon University, USA, Visiting Research Scholar.
2013.9-2018.1	University of Chinese Academy of Sciences, China, Doctoral Degree. (Major in Artificial Intelligence)
2009.9-2013.6	Harbin Institute of Technology, China, Bachelor Degree. (Major in Robotics and Control)

## 📁 PROJECT EXPERIENCES

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September 2021 September 2019	<b>DARPA Subterranean (SubT) Challenge, CMU, RI</b> <ul style="list-style-type: none"><li>&gt; Traversability Analysis For Underground Autonomous Divining Car.</li><li>&gt; Developing 3D Segmentation method with Sparse Annotations.</li><li>&gt; Develop rotation-invariant place features for LiDAR inputs.</li><li>&gt; Achieve Large Scale place recognition under variant orientation difference.</li></ul> <p><a href="#">Semantic Mapping</a> <a href="#">3D/2D Localization</a></p>
May 2019 April 2018	<b>Vision-based Place Recognition, CMU, RI</b> <a href="#">website</a> <a href="#">video1</a> <a href="#">video2</a> <a href="#">video3</a> <ul style="list-style-type: none"><li>&gt; Developing conditional-invariant features for place recognition (illumination, weather, etc).</li><li>&gt; Developing fast matching mechanism for efficient and accurate place recognition.</li></ul> <p><a href="#">Visual Place Recognition</a> <a href="#">Adversarial Feature Learning</a></p>
June 2018 September 2017	<b>LiDAR-based Place Recognition, CMU, RI</b> <a href="#">website</a> <a href="#">video1</a> <a href="#">video2</a> <ul style="list-style-type: none"><li>&gt; Developing Unsupervised LiDAR features for place recognition.</li><li>&gt; Improve Feature Extraction ability via adversarial feature learning.</li><li>&gt; Fusion multi-view information for feature extraction.</li></ul> <p><a href="#">3D Perception</a> <a href="#">3D LiDAR SLAM</a> <a href="#">Autonomous Driving</a></p>
May 2017 April 2016	<b>Field Autonomous Driving, UCAS, Shenyang</b> <a href="#">website</a> <a href="#">video1</a> <a href="#">video2</a> <a href="#">video3</a> <ul style="list-style-type: none"><li>&gt; Developing Autonomous Software Structure.</li><li>&gt; Developing Terrain Analysis Algorithm.</li><li>&gt; Developing Local Planning Method.</li></ul> <p><a href="#">Autonomous Driving</a> <a href="#">Terrain Analysis</a></p>
September 2016 April 2016	<b>DJI Developer Challenge 2016, UCAS, Shenyang</b> <a href="#">website</a> <a href="#">video</a> <ul style="list-style-type: none"><li>&gt; Develop Visual Tracking algorithm for UAV.</li><li>&gt; Develop Autonomous Navigation algorithm for UAV.</li></ul> <p><a href="#">3D Registration</a> <a href="#">Global Localization</a> <a href="#">GPU-enhanced</a></p>
April 2016 June 2015	<b>Crossing Area Multi-Robot Cooperation System, UCAS, Shenyang</b> <a href="#">website</a> <a href="#">video</a> <ul style="list-style-type: none"><li>&gt; Developing Global Registration method for multiple type robots.</li><li>&gt; Developing GPU-enhanced multi-resolution particle filter to speed up matching efficiency.</li></ul> <p><a href="#">3D Registration</a> <a href="#">Global Localization</a> <a href="#">GPU-enhanced</a></p>

**FAST SEQUENCE-MATCHING ENHANCED 3D PLACE RECOGNITION** IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS 2021 (Q1)

Peng Yin, Fuying Wang, Anton Egorov, Jiafan Hou, Zhenzhong Jia and Jianda Han

[paper](#)

This paper seeks to provide robots with a human-like place recognition ability using a new 3D feature learning method. This paper proposes a novel lightweight 3D place recognition and fast sequence-matching to achieve robust 3D place recognition, capable of recognizing places from a previous trajectory regardless of viewpoints and temporary observation differences.

[3D place recognition](#) [Fast Place Recognition](#)**PSE-MATCH : PARALLEL PLACE RECOGNITION** IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS 2021 (Q1)

Peng Yin, Lingyun Xu, Anton Egorov and Bing Li

In this work, we present PSE-Match, a viewpoint-free place recognition method based on parallel semantic analysis of isolated semantic attributes from 3D point-cloud models. Compared with the original point-cloud, the observed variance of semantic attributes is smaller. PSE-Match incorporates a divergence place learning network to capture different semantic attributes parallelly through the spherical harmonics domain.

[3D place recognition](#) [Spherical Harmonics](#)**ILOC : CONDITION INVARIANT ADDITIVE FEATURE EXTRACTOR FOR VISUAL LOCALIZATION** SCIENCE ROBOTICS 2021 (Q1)

Peng Yin, Ji Zhang, Changliu Liu, Ruohai Ge, Lingyun Xu, Howie Choset, and Sebastian Scherer

Major Revision

In this work, we provide a hippocampus inspired lifelong SLAM framework for long-term and large-scale localization.

[Hippocampus](#) [Place Recognition](#)**EYEGUIDE : A BIOLOGICAL INSPIRED VISUAL NAVIGATION SYSTEM** SCIENCE ROBOTICS 2022 (Q1)

Peng Yin, Abu, Ruohai Ge, Changliu Liu, Howie Choset and Sebastian Scherer

In Submission

In this work, we provide a hippocampus inspired lifelong SLAM framework for long-term and large-scale localization.

[Hippocampus](#) [Place Recognition](#)**ISIMLOC : HYBRID VISUAL LOCALIZATION FOR UAVS** IEEE TRANSACTION ON ROBOTICS 2021 (Q1)

Peng Yin, Ivan Cisnero, Lingyun Xu and Ji Zhang

Minor Revision

In this work, we provide a robust UAV 3D localization method for large-scale and confined environment.

[3D Localization](#) [Sim-to-Real](#)**AUTOMERGE : LIDAR BASED AUTOMATIC MULTI-ROBOT MAP MERGING** IEEE TRANSACTION ON ROBOTICS 2021 (Q1)

Peng Yin, Xin You, Ji Zhang and Sebastian Scherer

Major Revision

In this work, we provide a multi robot automatic map merging method.

[3D Localization](#) [Multi-robot](#) [Map Merging](#)**ADAFUSION : ADAPTIVE VISUAL-LIDAR BASED PLACE RECOGNITION** IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS 2021 (Q1)

Haowen Lai, Peng Yin, and Sebastian Scherer

Minor Revision

In this work, we provide a multi-sensor fusion based place recognition method, which can adaptive change the sensors' weights based on the observation properties.

[Adaptive Feature Fusion](#) [Place Recognition](#)**SPHEREVLAD++ : ATTENTION ENHANCED 3D PLACE RECOGNITION** IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS 2021 (Q1)

Peng Yin, Shiqi Zhao, Lingyun Xu, and Sebastian Scherer

Minor Revision

In this work, we provide a multi-sensor fusion based place recognition method, which can adaptive change the sensors' weights based on the observation properties.

[Adaptive Feature Fusion](#) [Place Recognition](#)**FUSIONVLAD : A MULTI-VIEW DEEP FUSION BASED 3D PLACE RECOGNITION** IEEE ROBOTICS AND AUTOMATION LETTERS 2021 (Q2)

Peng Yin, Lingyun Xu, Ji Zhang and Howie Choset

[paper](#)

In this letter, we propose FusionVLAD, a fusion-based network that encodes a multi-view representation of sparse 3D point clouds into viewpoint-free global descriptors.

[3D place recognition](#) [Multi-perspective Fusion](#)**GIDSEG : SPARSE ANNOTATIONS BASED 3D SEGMENTATION** IEEE ROBOTICS AND AUTOMATION LETTERS 2021 (Q2)

Peng Yin, Lingyun Xu, Ge Yi, Jianmin Ji, and Howie Choset

To alleviate manual efforts for 3D segmentation, we propose GIDSeg, a novel approach that can simultaneously learn segmentation from sparse annotations via reasoning global-regional structures and individual-vicinal properties.

[3D Segmentation](#) [Sparse Annotation](#)

Jianda Han, **Peng Yin**, Yuqing He, Feng Gu.

[website](#) [paper](#)

In this work, we introduce multi-resolution particle-filter framework for UAV/USV coordinate localization.

Global 3D registration Multi-robot Cooperative localization

**IDATA : DATASETS FOR GLOBAL VISUAL LOCALIZATION**

INTERNATIONAL JOURNAL OF ROBOTICS RESEARCH 2021 (Q1)

**Peng Yin**, Ruohai Ge, Zheng Xu, Ji Zhang and Sebastian Scherer

In Submission

In this work, we fast place recognition method for inconsistent indoor environments.

3D Localization Indoor Localization Conditional-invariant

## CONFERENCE PAPERS

**I3DLOC : CROSS-DOMAIN VISUAL LOCALIZATION**

ROBOTICS : SCIENCE AND SYSTEMS 2021 (CCF A)

**Peng Yin**, Lingyun Xu, Ji Zhang, Howie Choset, and Sebastian Scherer

We present a method for localizing a single camera with respect to a point cloud map in indoor and outdoor scenes, ignoring the environmental and viewpoint differences.

Place Recognition 2D-3D Localization

**BIOSLAM : A BIOLOGICAL INSPIRED INCREMENTAL GENERAL SLAM FRAMEWORK** ROBOTICS : SCIENCE AND SYSTEMS 2022 (CCF A)

**Peng Yin**, Abu, Changliu Liu and Sebastian Scherer

In Submission

We present a method for localizing a single camera with respect to a point cloud map in indoor and outdoor scenes, ignoring the environmental and viewpoint differences.

Incremental Place Recognition Hippocampus

**LPD-NET : 3D POINT CLOUD LEARNING FOR LARGE-SCALE PLACE RECOGNITION AND ENVIRONMENT ANALYSIS** ICCV 2019 (CCF A)

Zhe Liu, Shunbo Zhou, Chuanzhe Suo, Yingtian Liu, **Peng Yin**, Hesheng Wang, Yun-Hui Liu.

[website](#) [paper](#)

In this paper, we introduce a point cloud-based place recognition method, LPD-Net.

Place Recognition PointNet

**IMPROVING OFF-ROAD PLANNING TECHNIQUES WITH LEARNED COSTS FROM PHYSICAL INTERACTIONS**

ICRA 2021 (CCF B)

Matthew Sivaprakasam, Samuel Triest, Wenshan Wang, **Peng Yin**, Sebastian Scherer

We present a method of modifying a standard path planning algorithm to address these problems by incorporating a learned model to account for complexities that would be too hard to address manually.

Terrain Analysis Physical Interactions

**MRS-VPR : A MULTI-RESOLUTION SAMPLING BASED GLOBAL VISUAL PLACE RECOGNITION METHOD**

ICRA 2019 (CCF B)

**Peng Yin**, Rangaprasad Arun Srivatsan, Yin Chen, Xueqian Li, etc.

[website](#) [paper](#)

In this work, we introduce a multi-resolution sampling-based global visual place recognition method (MRS-VPR), which can significantly improve the matching efficiency and accuracy in sequential matching.

Place Recognition Sequence Matching

**A MULTI-DOMAIN FEATURE LEARNING METHOD FOR VISUAL PLACE RECOGNITION**

ICRA 2019 (CCF B)

**Peng Yin**, Lingyun Xu, Xueqian Li, Chen Yin, Yingli Li, etc.

[website](#) [paper](#)

In this work, we introduced an environmental condition-invariant feature extraction method for visual place recognition

Visual Place Recognition Condition-invariant

**SEQSPHEREVLAD : SEQUENCE MATCHING ENHANCED ORIENTATION-INVARIANT PLACE RECOGNITION**

IROS 2020 (CCF C)

**Peng Yin**, Fuying Wang, Anton Egorov, Jiafan Hou, Ji Zhang and Howie Choset

[paper](#)

In this paper, we provide novel 3D place recognition method, which is invariant to environmental conditions and viewpoint differences.

3D place recognition Conditional and Viewpoint-invariant

**STABILIZE AN UNSUPERVISED FEATURE LEARNING FOR LIDAR-BASED PLACE RECOGNITION**

IROS 2018 (CCF C)

**Peng Yin**, Lingyun Xu, Zhe Liu, Lu Li, Hadi Salman, Yuqing He.

[website](#) [paper](#)

In this work, we introduced an stabilization mechanism for LiDAR-based place recognition

LiDAR Place Recognition Stabilization

Peng Yin, Yuqing He, Lingyun Xu, Yan Peng, Jianda Han and Weiliang Xu.

[website](#) [paper](#)

In this work, we introduced an synchronous adversarial feature learning method for LiDAR based place recognition

[LiDAR Place Recognition](#) [Adversarial Feature Learning](#)

## SKILLS

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**Programming** C++, Python, ROS, Tensorflow, PyTorch.

**Algorithm** 3D LiDAR Mapping and Localization, 3D Semantic Segmentation, and Reinforcement Learning.

**Framework** Software System design for Mobile/Aerial/Legged robot systems.

## LANGUAGES

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Chinese ● ● ● ● ●  
English ● ● ● ● ●

## INTERESTS

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- > Movie
- > Cooking
- > Game