

Muyun Jiang

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EDUCATION

Nanyang Technological University, Singapore

August 2018 - August 2019

Master of Science, Computer Control and Automation; GPA: 4.5/5.0

- Dissertation Project: Lightweight Semantic Segmentation network for real-time Road Extraction
- Supervisor: Prof. Danwei Wang

Beijing Institute of Technology, PRC

August 2014 - August 2018

Bachelor of Engineering, Electrical Engineering and Automation; GPA 83/100

- Dissertation Project: SVPWM based Permanent Magnet Synchronous Motor drive and control system.
- Supervisor: Assoc. Prof. Lei Dong

WORK EXPERIENCE

Nanyang Technological University

September 2019 - Now

Research Associate in ST Engineering-NTU Corporate Laboratory

Vision and Inertial based UAV navigation in low light environment

- Carry out calibration tasks of camera to thermal camera, thermal camera to IMU.
- Implementing Visual-Inertial Odometry (VIO) algorithms, such as MSCKF and VINS-Mono for UAV navigation.
- Improve Visual Odometry (VO) performance using Line-Junction-Line structural in low texture environments.

Airplane 3D Pose Estimate in image and RGBD point cloud

- Implementing algorithms for instance segmentation and object tracking using Mask-RCNN and DeepSORT.
- Calculate disparity map from stereo cameras for object depth estimation and RGBD point cloud generation.
- Develop algorithms for 3D Model Retrieval for the detected and tracked object.

Data-Driven time serial data analysis for Fault Detection and Fault Diagnosis

- Purpose Bagging Stochastic Variational GP Regression (BSVGPR) for Soft Sensor process monitoring
- Purpose Conditional Recurrent Variational Autoencoder (CR-VAE) for Fault Detection and Fault Diagnosis

PUBLICATIONS

[1] Jinlin Zhu*, **Muyun Jiang***, Zheng Zhang, Danwei Wang, Complex Industrial Process Modeling and Monitoring with Conditional Recurrent Variational Autoencoder, **IEEE Transactions on Industrial Informatics** (under review)

[2] Jinlin Zhu*, **Muyun Jiang***, Guohao Peng, Zhiqiang Ge, Intelligent Soft Sensor Development for Nonlinear Industrial Big Data via Bagging Bayesian Gaussian Processes, **IEEE Transactions on Industrial Electronics** (Major Revision)

* Equally Contribution

[3] Guohao Peng, Jinlin Zhu, **Muyun Jiang**, Danwei Wang, Yufeng Yue, ShadowVLAD: Attentional Encoding and Matching for Place Recognition, **ECCV 2020** (under review)

[4] Xiaoyu Tang, Wenhao Fu, **Muyun Jiang**, Guohao Peng, Danwei Wang, Place Recognition Using Line-Junction-Line in Urban Environment, **IEEE CIS-RAM 2019**

[5] **Muyun Jiang**, Jiahui Shi, Hongbin Ma, You Li, A Vision and Neural Network based Air-ground Coordinated Control System, **IEEE ICUS 2017**

SKILLS

Proficient in: C, C++, Python, MATLAB, TensorFlow, PyTorch, ROS, OpenCV, Open3D, Kalibr.

Familiar with C#, Golang, Docker, CUDA Programming

RESEARCH PROJECTS

Intelligent Soft Sensor Development for Nonlinear Industrial Big Data via Bagging Bayesian Gaussian Processes

Traditional Gaussian process regression (GPR) suffers from the cubic complexity and excessive computation burdens for industrial big data. To get rid of such defect, this work proposes a scalable soft sensor called bagging stochastic variational GP regression (BSVGPR), which can significantly break the formidable obstacle to nonlinear big data modeling. Based on that, the bagging mechanism is encompassed by combining a set of distributed predictors to form a powerful ensemble model. For case study demonstrations, the proposed method is first evaluated on the numerical example and then applied on the real-time oxygen prediction of the hydrogen manufacturing unit.

Complex Industrial Process Modeling and Monitoring with Conditional Recurrent Variational Autoencoder

To account for nonlinear, dynamic and multiple operating conditions properties challenges in complex industrial processes, this work introduces a systematic flowchart for statistical process modeling and monitoring with the deep neural network (DNN) prototype. For data-driven modeling, a novel conditional recurrent variational autoencoder (CRVAE) has been proposed to deal with the nonlinear, dynamic and multi-mode properties unitedly. After that, a systematic fault detection panel is established for latent, residual and combined domains, and then a global detection scheme is further developed by investigating the total loss density. Following the detection results, a feature relevance propagation technique is finally constructed to make the empirical fault diagnosis. For case study, the performance of the proposed method has been comprehensively validated on the industrial benchmark Tennessee Eastman Process.

ShadowVLAD: Semantic attentional NetVLAD encoding and matching for Place Recognition

To cope with the uneven distribution and the unequal discriminability of visual cues in an image, we provide an attention-regulated encoding paradigm named ShadowVLAD. The paradigm adopts a hierarchical weighted embedding mechanism for both attention-aware local refinement and global integration. By this means, discriminative visual words play a more important role in similarity voting during indexing. All proposed modules are differentiable and can be optimized in an end-to-end manner. Experiments demonstrate that the purposed methods outperform previous state-of-the-art on city-scale VPR benchmark data sets.

Place Recognition using Line-Junction-Line structure in urban environment

To improve the Visual Odometry (VO) performance in challenging environments, we propose a novel Line-Junction-Line (LJL) descriptor to build the Bag of Word (BoW) dictionary for robust place recognition in urban environments. Line-Junction-Line is a structure of two lines with their intersection, representing a structure with physical existence and encodes the relationship between the two lines. Experiments on HPatches Dataset demonstrate the superiority of LJL comparing to traditional visual descriptor such as ORB or SIFT, and much faster than learned descriptors such as SuperPoint or D2-Net.

姜牧云

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教育经历

新加坡南洋理工大学 Nanyang Technological University, Singapore

2018 年 8 月 – 2019 年 8 月

- 专业：计算机控制及其自动化 Computer Control and Automation; GPA: 4.5/5.0
- 学位：全日制研究生 Master of Science
- 毕业论文：用于实时道路提取的轻量级语义分割网络（指导教师：Prof. Danwei Wang）

北京理工大学

2014 年 8 月 – 2018 年 8 月

- 专业：电气工程及其自动化 GPA: 83/100
- 学位：全日制本科
- 毕业论文题目：基于 SVPWM 的 AGV 永磁同步电动机驱动和控制系统（指导教师：冬雷）

工作经历

新加坡南洋理工大学 Nanyang Technological University, Singapore

2019 年 9 月 – 至今

- 职位：助理研究员 Research Associate
- 单位：新加坡科技集团-南洋理工大学联合实验室 ST Engineering-NTU Corporate Laboratory

弱光环境下基于视觉和 IMU 融合的无人机导航

- 进行传感器标定，包括 RGB 相机与热感应相机的标定，热感应相机与 IMU 的标定任务。
- 实现与 IMU 融合的视觉里程表（VIO）算法，例如 MSCKF 和 VINS-Mono，用于无人机位姿估计。
- 在低纹理环境中使用 Line-Junction-Line 结构改善视觉里程表（VO）性能。

图像和 RGBD 点云中的飞机 3D 姿势估计

- 使用 Mask-RCNN 和 DeepSORT 实现实例分割和对象跟踪的算法。
- 通过立体相机，计算视差图（Disparity Map），以进行物体深度估计和 RGBD 点云生成。
- 开发 3D 模型回归算法，为检测跟踪的物体拟合 3D 模型。

数据驱动时序数据分析，用于故障检测和诊断

- 提出用于软传感器过程监控的，集成变分高斯过程回归（Bagging Stochastic Variational GP Regression）
- 提出用于故障检测和故障诊断的，多模态条件循环变分自编码器（Conditional Recurrent Variational Autoencoder）

发表论文

- [1] Jinlin Zhu, **Muyun Jiang (共同一作)**, Zheng Zhang, Danwei Wang*, Complex Industrial Process Modeling and Monitoring with Conditional Recurrent Variational Autoencoder, **IEEE Transactions on Industrial Informatics** (审稿中)
- [2] Jinlin Zhu, **Muyun Jiang (共同一作)**, Guohao Peng, Zhiqiang Ge*, Intelligent Soft Sensor Development for Nonlinear Industrial Big Data via Bagging Bayesian Gaussian Processes, **IEEE Transactions on Industrial Electronics** (Major Revision)
- [3] Guohao Peng, Jinlin Zhu, **Muyun Jiang**, Danwei Wang, Yufeng Yue*, ShadowVLAD: Attentional Encoding and Matching for Place Recognition, **ECCV 2020** (审稿中)
- [4] Xiaoyu Tang, Wenhao Fu, **Muyun Jiang**, Guohao Peng, Danwei Wang*, Place Recognition Using Line-Junction-Line in Urban Environment, **IEEE CIS-RAM 2019**
- [5] **Muyun Jiang**, Jiahui Shi, Hongbin Ma*, You Li, A Vision and Neural Network based Air-ground Coordinated Control System, **IEEE ICUS 2017**

技能

熟练使用：C, C++, Python, MATLAB, TensorFlow, PyTorch, ROS, OpenCV, Open3D, Kalibr.

熟悉：C#, Golang, Docker, CUDA Programming

科研项目内容

通过集成贝叶斯高斯过程对非线性工业大数据进行智能软传感器开发

传统的高斯过程回归（GPR）遭受立方复杂性和工业大数据过多的计算负担的困扰。为了消除这种缺陷，这项工作提出了一种可扩展的软传感器，称为集成随机梯度下降变分高斯过程回归（BSVGPR）。我们首先在稀疏和变分近似框架内推导高斯过程原理。然后，引入了随机变分推理（SVI）机制，可以极大地打破非线性大数据建模的巨大障碍。另外，强加的自动相关性确定策略还将利用相关特征权重来利用模型的可解释性。基于此，通过组合一组分布式预测变量以形成强大的集成模型，就可以包含套袋机制。结果，提高了预测精度，同时也很好地保证了稳定性。SVI 和模型集成机制都允许并行部署。因此，开发了用于建模和推理的分布式推理框架，以便 BSVGPR 可以有效地探索大数据。为了进行案例研究演示，首先在数值示例上评估所提出的方法，然后将其应用于制氢装置的实时氧气预测。

基于条件变分递归自动编码器的多模态过程监控方法

随着大量多传感器的多变量测量数据的存储，现代制造工厂不仅需要更智能的系统，而且还需要更安全，更可靠的过程监控系统。在这项工作中，提出了一种新的基于条件循环变分自编码器（CRVAE）的数据驱动过程监控方法。与传统的多元统计过程监控方法不同，该方法在概率空间中监控过程，从而使其能够处理过程非线性。所提出的方法还通过利用递归神经网络（RNN）处理过程动力学，该过程考虑了变量之间的时间依赖性。提出了多中心深度支持向量数据描述（Deep SVDD）作为监控指标。将该方法的性能与传统方法以及另一种基于神经网络的方法进行了简单的非线性仿真和基准仿真 TE 过程故障检测性能比较。

ShadowVLAD: 用于位置识别的语义注意力增强的 NetVLAD 编码和匹配

本文解决了大规模的视觉场所识别（VPR）问题。为了应对图像中视觉提示的不均匀分布和不平等的可分辨性，我们提供了一种名为 ShadowVLAD 的注意调节编码范例。该范例采用层次加权的嵌入机制来实现关注注意力的局部优化和全局集成。局部细化将语义先验和局部双重加权方案组合到一个可解释的模块中，在该模块中，局部特征被聚类，细化和量化为信息性视觉单词表示。对于全局集成，已经提出了加权相似投票核，以将这些异构表示嵌入具有不同权重的最终图像描述符中。通过这种方式，区分性视觉词在索引期间的相似性投票中起着更重要的作用。所有建议的模块都是可区分的，并且可以以端到端的方式进行优化。即使没有像素级注释，所获得的注意力也将与人类行为模式保持一致。实验表明，ShadowVLAD 在城市规模的 VPR 基准数据集方面优于以前的最新技术。

在城市环境中使用 Line-Junction-Line 结构进行位置识别

位置识别在消除 SLAM 系统中视觉里程计中的累积漂移中起着至关重要的作用。视觉位置识别已被认为是一项非常具有挑战性的任务，因为传统的图像关键点描述符在多次遍历期间会遭受位置变化的影响。我们提出了一种新颖的 Line-Junction-Line（LJL）描述符来构建词袋（BoW）词典，以在城市环境中实现可靠的位置识别。Line-Junction-Line 是两条直线相交的结构。LJL 优于基于像素强度算子（例如 ORB 或 SIFT）检测到的那些描述符，因为它表示具有物理存在的结构，对于具有挑战性的场景而言更健壮。而且，它的描述符是独特的，并且对两条线之间的关系进行编码。在 KITTI 数据集上进行的实验表明，与使用经过点或线特征训练的 BoW 进行环路检测相比，该方法的有效性。

用于实时道路提取的轻量级语义分割网络

该项目旨在对配备自动在城市街道中飞行的摄像头的无人机进行自动导航。为了提高受计算能力限制的平台的性能，而不是损失精度，该模型使用了从最新技术中学到的几种技术。基于完全卷积网络，使用膨胀卷积，金字塔池，深度和点可分离卷积来减少模型的参数。二元交叉熵加权的 IOU（Intersection over Union）Loss 被用作损失函数。编码器/解码器跳过连接用于将低级功能与高级功能组合在一起，并且批标准化，Leaky-ReLU 激活功能也用于提高模型泛化能力。