

Linfeng Cao

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EDUCATION

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| Sep. 2018-Present | Shanghai Jiao Tong University
Candidate for Master of Mechatronic Engineering
Robotics Institute, School of Mechanical Engineering <ul style="list-style-type: none">● Research area: Non-invasive brain computer interface, Robot control● GPA: 3.42/4.00● Honor & Awards: First-class Scholarship/ Second-class Scholarship |
| Sep. 2014-Jun. 2018 | Southwest Jiaotong University
Bachelor of Vehicle Engineering
School of Mechanical Engineering <ul style="list-style-type: none">● GPA: 3.63/4.00 (top 2%)● Honor & Awards: Tongmao Scholarship, Merit Student, Innovation Award |

PROJECT & ACADEMIC EXPERIENCE

A Brain-Actuated Robotic Arm System Using Non-invasive Hybrid Brain-Computer Interface and Shared Control Strategy

Sep. 2019 - Present

- Implemented a hybrid brain computer interface (BCI) scheme (i.e., integrated motor imagery and steady-state visual evoked potentials) and the corresponding parallel decoding algorithm to increase the control dimension of the brain-actuated system
- Designed a simple graphical user interface (GUI) and an intuitive BCI control logic to provide better human-computer interaction for the user experience
- Proposed a shared control strategy which inferred the user's intention, constructed the machine autonomy and human intention models dynamically based on the inference confidence and user's characteristic, and fused them using Bayesian fusion theory to provide machine automatic assistance during online control, thus enhanced the BCI control performance
- This work has been submitted to Journal of Neural Engineering

Object Recognition and Pose Estimation of Task Scene

Jan. 2019 - Sep. 2019

- Implemented an FCN network for the target object recognition and point cloud segmentation in the picking task scene of robotic arm, and employed the ICP algorithm to obtain the poses of the segmented objects, which were used as the knowledge base of the online BCI experiment (This work served for the machine vision perception function in the brain-actuated robotic arm system)

A Shared Control Strategy for Reach and Grasp of Multiple Objects Using Robot Vision and Non-invasive Brain-Computer Interface

Nov. 2018 - Apr. 2019

- Utilized a simple left- vs right- hand motor imagery as non-invasive BCI paradigm to control the movement of the robotic arm and proposed a parallel shared control strategy based on machine vision guidance to integrate the user's BCI command and the machine instruction for providing the machine independent auxiliary control (mainly involved in the design of EEG interface paradigm, the design of shared control principle and experiments)
- This work has been published in IEEE Transactions on Automation Science and Engineering

Visual Intelligence Analysis (Mathematical contest in modeling)

Sep. 2019

- Aiming at the problem of camera parameter calibration and image content analysis without camera parameters, combined with the invariant information in perspective projection, the calculation of camera matrix and daily prior information to reverse information in the single image, and combined two or more frames of video information to perform camera parameter calibration and 3D reconstruction of objects in videos (mainly responsible for the construction of UAV video information inverse model and the writing of related content)
- This work won the second prize of the "Huawei Cup" 16th China Post-Graduate Mathematical Contest in Modeling

PATENT/PUBLICATION

1. **L. Cao**, G. Li, Y. Xu, H. Zhang and D. Zhang, "A Brain-Actuated Robotic Arm System Using Non-invasive Hybrid Brain-Computer Interface and Shared Control Strategy", Journal of Neural Engineering, 2020, under review. (SCI)
2. Y. Xu, H. Zhang, **L. Cao**, X. Shu and D. Zhang, "A Shared Control Strategy for Reach and Grasp of Multiple Objects Using Robot Vision and Noninvasive Brain-Computer Interface", IEEE Transactions on Automation Science and Engineering, 2020, accepted. (SCI)
3. Utility model patent, "一种压感能源装置", No: 201720477072.4
4. Utility model patent, "一种具有能量采集功能的高压电力线防震锤系统", No: 201720688201.4

LEADERSHIP EXPERIENCE

Department of Propaganda, Student Union of School of Mechanical Engineering, Southwest Jiaotong University

Sep. 2014-Jun. 2016

- Organized a number of activities (e.g., college basketball match, football match, campus singer competition, etc.), mainly responsible for poster production and multimedia publicity of related activities
- Organized the off-line training of graphic design, video production and other related courses, and acted as the training instructor of some courses

SKILLS & INTERESTS

- Programming: Python, C/C++, Matlab
- Language: English (CET-6)
- Other Software: Photoshop, Premiere, KeyShot
- Interest: painting, physical exercise, travelling, food

曹林峰



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教育经历

- 2018.09-至今 **上海交通大学**
机械电子 硕士
机械与动力工程学院 (机器人研究所)
- 研究方向: 非侵入式脑机接口, 机器人控制
 - GPA: 3.42/4.00
 - 荣誉奖项: 上海交通大学研究生一等奖学金/二等奖学金
- 2014.09-2018.06 **西南交通大学**
车辆工程 本科
机械工程学院
- GPA: 3.63/4.00 (top 2%)
 - 荣誉奖项: 通茂奖学金, 三好学生, 西南交通大学创新奖

项目和科研经历

- 基于非侵入式混合脑机接口与共享控制的脑控机械臂系统** 2019.09-至今
- 针对目前非侵入式脑机接口技术存在的控制维度低的局限性, 开发混合脑机接口范式 (i.e., 运动想象+稳态视觉诱发电位) 与并行解码算法以实现准确稳定的多维指令输出, 为脑控设备在复杂任务中的应用提供了新的解决方案
 - 设计开发了简洁直观的 GUI 与脑机控制逻辑, 保证控制要求的同时优化人机交互体验
 - 针对脑机接口技术在线控制效果不理想的问题, 设计了脑、机共享控制策略, 在控制过程中引入机器视觉引导的自主辅助: 采用基于最大熵理论的目标预测算法以实时更新用户意图和机器自主控制的概率模型, 并利用贝叶斯理论对两者进行融合, 从而为用户提供智能辅助, 优化控制表现
 - 相关成果正投稿于 Journal of Neural Engineering 期刊
- 基于机械臂抓取任务场景的物体识别与位姿估计** 2019.01-2019.09
- 针对机器人抓取任务中场景的随机性, 采用 FCN 网络来实现目标物体的识别与点云切割, 并对切割后的物体点云利用 ICP 算法求取位姿, 以作为机械臂任务执行时的知识库 (该工作用于支持脑控机械臂系统的机器视觉感知功能)
- 基于机器人视觉和非侵入式脑机接口的多物体抓取共享控制策略** 2018.11-2019.04
- 设计以简单的左、右手运动想象 (2 类) 信号为非侵入式脑机接口范式, 控制机械臂运动。并提出了一种基于机器视觉引导的并行共享控制策略, 根据机械臂位置信息与预设权重进行用户指令与

机器指令的融合，为用户提供机器自主辅助控制（本人主要参与脑电接口范式设计、共享控制权重设计与实验开展工作）

- 相关成果已发表于 IEEE Transactions on Automation Science and Engineering 期刊

视觉情报分析（数学建模竞赛）

2019.09

- 针对在缺少相机参数的情况下利用图像进行相机参数标定和图像物体测量分析问题，以世界，相机，图像，像素坐标系及其透视投影等几何成像理论作为支撑基础，对单目视觉系统的单幅图通过结合透视投影中不变量信息和摄像机矩阵计算原理以及日常先验信息，进行求解。对于视频信息，通过结合两帧或多帧的图像信息进行相机参数计算和三维重建。本人主要负责无人机视频信息反解模型的构建以及相关内容的撰写
- 该工作获“华为杯”第十六届中国研究生数学建模竞赛二等奖

专利/论文

1. L. Cao, G. Li, Y. Xu, H. Zhang and D. Zhang, "A Brain-Actuated Robotic Arm System Using Non-invasive Hybrid Brain-Computer Interface and Shared Control Strategy", Journal of Neural Engineering, 2020, under review. (SCI)
2. Y. Xu, H. Zhang, L. Cao, X. Shu and D. Zhang, "A Shared Control Strategy for Reach and Grasp of Multiple Objects Using Robot Vision and Noninvasive Brain-Computer Interface", IEEE Transactions on Automation Science and Engineering, 2020, accepted. (SCI)
3. 实用新型专利“一种压感能源装置”，专利号：201720477072.4
4. 实用新型专利“一种具有能量采集功能的高压电力线防震锤系统”，专利号：201720688201.4

社团和组织经历

西南交通大学机械工程学院学生会 创意宣传部

- 组织策划多项院级、校级活动（机械工程学院篮、足球赛，校园十佳歌手等），主要负责相关活动的海报制作及多媒体宣发工作
- 组织部员进行平面设计、视频制作等相关课程的线下培训，同时担任部分课程的培训导师

技能/证书及其他

- 基本编程技能：Python, C/C++, Matlab 等编程语言
- 深度学习框架：TensorFlow
- 语言：英语（CET-6）
- 其他软件：Photoshop, Premiere, KeyShot 等
- 兴趣爱好：绘画，锻炼，旅游，美食