Yongxia Liu

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Education

Zhejiang University (ZJU) **Hangzhou**
M.S. in Electrical Engineering *Sep. 2016 – Mar. 2019*
GPA: 3.67 / 4.0 ranking: no official ranking
Dissertation: Fault-tolerant Control of Modular Multilevel Converter for Sub-module Fault
Related courses: Biochemistry and Molecular Biology (92/100), Machine Learning (87), Computer Aided Design for Power Electronic System (95)
Online courses: Data Structure (98), Genomics (99), Discrete Mathematics (98.2).

Harbin Institute of Technology (HIT) **Harbin**
B.S. in Electrical Engineering and Automation *Sep. 2012 – Jun. 2016*
GPA: 3.91 / 4.0 ranking: 4 / 289
Dissertation: Control of Dual Active Bridge Bidirectional DC/DC Converter
Related courses: Calculus I (100), Calculus II (94), Linear Algebra and Analytic Geometry (97), Probability Theory and Mathematical Statistics (95), Methods of Optimization (100), C Programming Language (92), College Chemistry (92), Mathematical Modeling (96), Equations of Mathematical physics (96), Principle and Application of Microcomputer (97), College Physics I (93), College Physics II (93), Dissertation (95).

Programming Skills

C/C++, MATLAB, Python, R (Basic)

Selected Researches & Projects

For details and codes of all researches and projects, please visit my website: https://liuyox.github.io/.

1. Extraction, restoration and tracking of foreground in surveillance video (team leader)
Sep. 2017 – Dec. 2017

Programming language: MATLAB and Python

Object: Most of monitoring videos' frames are only background. So, it is necessary to extract the frames that contain foreground and abandon others to compress videos.

Methods: If the background contains something trembling, such as leaves blown by wind, ViBe (a kind of clustering algorithm) and Gaussian Mixture Model are effective to extract the foreground. Furthermore, if the background moves due to the shaking camera, a new-proposed method helps calculate the camera's displacement and restore the background to be stable. In addition, multiple cameras can shoot the same scene from different angles to present more information from multiple perspectives, and the Homography Theory can be used to identify the same object from different videos, track the foreground objects interested in and restore the 3-dimensional objects.

Results: The False-positive rate (FPR) of picking out the frames containing foreground is 99%. FPR of outlining foreground is 92% and the recall rate is 90%.

2. Arc fault detection for electrical equipment using machine learning *Sep. 2018 – Apr. 2019*

Programming language: Python

Object: Arc fault, an abnormal discharge phenomenon caused by breakage of the insulation material or loosening of conductor connector in circuits, which seriously threatens the security of electrical equipment. Consequently, this research aims at detecting arc fault based on signal processing and machine learning.

Methods: Gathering current signal of electrical equipment, we utilize deep learning and signal analysis tools such as Fourier transform, wavelet transform to analyze and extract the features of current signals in the circuit, and then use clustering, decision tree, SVM, Gaussian mixture model or deep learning including CNN and RNN to determine whether arc fault occurs or not.

Results: Under the condition of 0.72% false detection rate, the recall rate of arc fault is 93.68%.

3. Design of Intelligent Tracking Vehicle Based on Machine Vision and Automatic Control (team leader)

Oct. 2014 – Jun. 2015

Programming language: C

Object: Provided with a standard car model, DC motors and rechargeable batteries, teams are expected to design a smart car that can automatically identify the specially designed road. The winner is the fastest runner to complete the race without running out of the road.

Methods: This design covers sensing technology, mechanics, pattern recognition, automatic control and so on. In this design, the hardware of intelligent car is elaborated on, digital camera and photoelectric encoder are utilized to gather real-time running states of the car. The software control is written by C language using modular structure to process images from camera using computer vision algorithms, then automatically control the speed and direction of the car.

Results: The intelligent car can run at a speed of 3m/s without running out of the road.

4. Fault-tolerant Control of Modular Multilevel Converter for Sub-module Fault (individual project)

Oct. 2017 – Jun. 2018

Programming language: C and MATLAB

Object: Modular Multilevel Converter (MMC) consists of hundreds of identical sub-modules. If some sub-modules fail, it is very important to find methods to keep MMC running normally.

Methods: Circuit model is transformed to mathematical model for calculating to control active power and reactive power separately. If sub-modules fail, use a new method combining cold and hot redundancy, which can alleviate the remarkable circulating current and overvoltage of capacitance in traditional methods. If no redundancy is left, a new method combining third harmonic injection and basic frequency circulating current suppressor can play an important role in keeping MMC running normally.

Result: An accurate simulating model verifies the effectiveness of fault-tolerant control methods.

Publications

1. *Thermal Analysis of Modular Multilevel Converters Under Subsynchronous Oscillation*
   Yongxia Liu, Jing Sheng, Yufei Dong, Renju Zheng, Wuhua Li, Xiangning He, Zhichao Zhou.
   2018 IEEE Energy Conversion Congress and Expo (ECCE 2018).
   * ECCE is recognized as a top conference in power electronics.

2. *Anomaly Detection for Time Series Using Temporal Convolutional Networks and Gaussian Mixture Model*
   Jianwei Liu, Hongwei Zhu, **Yongxia Liu**, Haobo Wu, Yunsheng Lan, Xinyu Zhang.
   2018 International Conference on Information Science, Computer Technology and Transportation

(ISCTT 2018).

3. *An Equivalent Circuit Model and Transient Performance Analysis of Hybrid DC Circuit Breaker*
   Yongxia Liu, Yufei Dong, Wuhua Li, Xiangning He.
   2017 China Power Supply Society Conference (CPSSC 2017).
   * This paper helped me win the excellent reporter of CPSSC Parallel Session.
   * CPSSC is recognized as a top conference in power electronics in China.

Patents

4. *Topology and Control of Energy Router for DC Distribution Network Based on PWM Diode Hybrid Converter*
   Wuhua Li, Heya Yang, Yufei Dong, **Yongxia Liu**, Junsong Tang, Xiangning He.
   Invention patent of China, public No. 108270356A (under substantial examination), 2018

5. *An Active-bypass Control Method to Suppress Thermal Impulse for MMC Under Single-Phase-to-Ground Fault*
   Wuhua Li, Heya Yang, Yufei Dong, **Yongxia Liu**, Xiangning He.
   Invention patent of China, public No. 108270349A (under substantial examination), 2018

Talks

- *Thermal Analysis of Modular Multilevel Converters Under Subsynchronous Oscillation*
  ECCE'18, Portland, September 2018.

- *An Equivalent Circuit Model and Transient Performance Analysis of Hybrid DC Circuit Breaker*
  CPSSC'17, Shanghai, November 2017.
  The Excellent Reporter of CPSSC Parallel Session.

Honors & Awards

- **Excellent League Member of ZJU (2/48)**, Zhejiang University, 2018.
- **The 2nd prize of National Post-Graduate Mathematical Contest in Modeling (ranking 2nd in ZJU)**, NPGMCM Organizing Committee, 2017.
- **Excellent Reporter of China Power Supply Society Conference Parallel Session**, CPSSC, 2017.
- **Outstanding Undergraduate of HIT (top 10%)**, Harbin Institute of Technology, 2016.
- **Excellent Undergraduate dissertation of School of Electrical Engineering and Automation, HIT (top 3%)**, School of Engineering and Automation, HIT, 2016.
- **The 1st prize of International Mathematical Contest in Modeling (Meritorious Winner)**, the Consortium for Mathematics and Its Applications, 2015.
- **The 1st prize of National Undergraduate Electronic Design Contest (Heilongjiang District)**, NUEDC Organizing Committee, 2015.
- **Merit Undergraduate of Heilongjiang Province (top 1%)**, Education Department of Heilongjiang Province, 2015.
- **The 2nd prize of National Undergraduate Mathematical Contest in Modeling**, China Society for Industrial and Applied Mathematics, 2014.
- **Excellent League Member of HIT (top 10%)**, Harbin Institute of Technology, 2014.

- **The 1st prize of National Undergraduates Mathematics Contest Preliminary Contest (top 0.1%)**, China Mathematical Society, 2013.
- **Merit Student of HIT (top 10%)**, Harbin Institute of Technology, 2013.
- **National Scholarship (top 1%)**, Ministry of Education of China, 2013.
- **People's Scholarship (seven times, top 12%)**, Harbin Institute of Technology, 2012 – 2016.

Social Experiences

- Leader of "Project Leader Training Program" for School of Electrical Engineering and Automation, HIT, Jan. 2015 – Jan. 2016.