

Yongxia Liu

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Education

Zhejiang University (ZJU)

M.S. in Electrical Engineering

GPA: 3.67 / 4.0

ranking: 8 / 48

Advisor: Prof. Xiangning He and Dr. Hongwei Zhu

Dissertation: Fault-tolerant Control of Modular Multilevel Converter for Sub-module Fault

Hangzhou

Sep. 2016 – Mar. 2019

Harbin Institute of Technology (HIT)

B.S. in Electrical Engineering and Automation

GPA: 3.91 / 4.0

ranking: 4 / 289

Advisor: Prof. Dianguo Xu (Vice president of HIT, IEEE Fellow)

Dissertation: Control of Dual Active Bridge Bidirectional DC/DC Converter

Harbin

Sep. 2012 – Jun. 2016

Programming Skills

C/C++, MATLAB, Python, Linux, TensorFlow

Selected Researches & Projects

1. Arc Fault Detection for Electrical Equipment Using Machine Learning

Sep. 2018 – Apr. 2019

Object: Arc fault, an abnormal discharge phenomenon caused by the insulation breakage of circuits, which increases the risk of fire. Thus, 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%. **The arc-fault detecting circuit breakers have been manufactured and used in the air-conditioners and firefighting equipment to reduce fire risk. It is the first time that machine learning is used to detect arc fault in electrical equipment in China (maybe also the world).**

2. Face Verification using MTCNN and FaceNet (individual project)

Oct. 2017 – Jan. 2018

Object: Detect and align the faces in two photos and evaluate whether they are the same person using deep learning methods.

Methods: The MTCNN model is trained on two datasets, WIDER FACE and Celeba. FaceNet is trained on CASIA webface dataset after all photos in CASIA webface are detected and aligned with MTCNN. The 128-dimensional features of each photo are extracted using FaceNet, and then the similarity of the two face images is calculated by cosine distance to evaluate whether two photos are the same person. Besides, 10-fold cross validation is used to selected threshold for face verification.

Results: The accuracy of face verification is 98.6% in LFW dataset.

3. A self-driving intelligent car based on image processing and automatic control (team leader)

Oct. 2014 – Jun. 2015

Object: Provided a standard car model, CCD camera, DC motors and rechargeable batteries, contest teams are expected to design a self-driving intelligent car that can run along the racetrack automatically. The winner is the fastest car without running out of the racetrack.

Methods: This design covers robotics, sensing technology, mechanics, pattern recognition, automatic control and so on. The hardware part of intelligent car is designed on PCB by Altium Designer. Digital CCD camera and photoelectric encoder are utilized to gather real-time status of the car. The software control codes are written by C language to process images using computer vision algorithms, then automatically control the speed, direction and status of the car.

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

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

Oct. 2017 – Mar. 2019

Object: MMC consists of hundreds of identical sub-modules (SMs). If some SMs fail, methods are needed to keep MMC running normally.

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

Result: A simulation model and a prototype are both established to verify the effectiveness of fault-tolerant control methods. **The prototype was sold to Arizona State University for experiments.**

5. Extraction, Restoration and Tracking of Foreground in Surveillance Video (team leader) *Sep. 2017*

Object: Most of monitoring videos' frames only contain 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, tracking the foreground objects and restoring the 3-dimensional objects.

Results: The precision of picking out the frames containing foreground is 99%. The precision of outlining foreground is 92% and the recall rate is 90%.

Publications

1. *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.
Journal of Physics: Conference Series, vol. 1187, no. 4, pp. 1 – 10, Apr. 2019
2. *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.

3. *An Equivalent Circuit Model and Transient Performance Analysis of Hybrid DC Circuit Breaker*

Yongxia Liu, Yufei Dong, Wuhua Li, Xiangning He.

The 22nd China Power Supply Society Conference, 2017

* This paper helped me win the excellent reporter of CPSSC.

* CPSSC is recognized as a top conference in power electronics in China.

Patents

4. *MMC Single-phase AC Ground Fault Thermal Shock Inhibition Control Method Based on Active Bypass*

Wuhua Li, Heya Yang, Yufei Dong, **Yongxia Liu**, Xiangning He.

Invention patent of China, Patent No. CN 108270349 B, 2019.

5. *DC Power Distribution Network Energy Router Based on PWM/diode Hybrid Rectification Structure, and Control Method for DC Power Distribution Network Energy Router*

Wuhua Li, Heya Yang, Yufei Dong, **Yongxia Liu**, Junsong Tang, Xiangning He.

Invention patent of China, Application No. 201810084539 (under substantial examination), 2018.

Presentations

- *Anomaly Detection for Time Series Using Temporal Convolutional Networks and Gaussian Mixture Model*
ISCTT'18, Xi'an, December 2018.
- *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 (10 out of 248)**, CPSSC, 2017.
- **Outstanding Undergraduate of HIT (top 10%)**, Harbin Institute of Technology, 2016.
- **Excellent Undergraduate Dissertation Award 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 Province)**, 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 “the Project Leaders Training Program” for School of Electrical Engineering and Automation, HIT, Jan. 2015 – Jan. 2016.