PHONG NGUYEN

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RESEARCHER & DATA GURU

A results-oriented researcher and data guru with vast managerial and technical experience. Specializes in artificial intelligence and research management. Proficient performing complex data analyses to derive insights, building various (deep) machine learning models for prediction, and training (deep) reinforcement learning agents in industrial applications and systems. Adept at programming, such as Python, Java, and R. Possesses vast amount of international experience. Excellent communicator with the innate ability to lead teams and manage multiple projects. Passionate with education and excellent in tutoring and teaching. Fluent in English and Vietnamese. A little of Japanese and Chinese.

AREAS OF EXPERTISE

- Data Science
- Machine Learning
- Artificial Intelligence
- Data Mining
- Business Intelligence
- Project Management
- Written/Oral Communication
- Teaching & Mentoring
- Business & Marketing

PROFESSIONAL EXPERIENCE

HITACHI CENTRAL RESEARCH LABORATORY, JAPAN 2013 – PRESENT

RESEARCHER

- Research to find new algorithms for artificial intelligence in the field of deep learning and deep reinforcement learning.
- Apply research results in industrial applications and systems
  - ✓ Intelligent Transportation System
  - ✓ Indoor Positioning
  - ✓ Water Purification Plants
  - ✓ Manufacturing Plants and Factories
  - ✓ Banking: ATM system and Credit system
  - ✓ Robot Navigation
- Facilitate and manage a global research project with team members from Japan, Singapore, India and Vietnam.
- Key person in developing collaboration with MILA – Quebec AI Institute, working with Yoshua Bengio, Turing Award Winner, in Explainable AI.

KEY ACCOMPLISHMENTS

- Research surmised of *12 published papers* in international conferences, *8 patents*, *2 scientific journal papers*.
- Hitachi internal awards: *Top 50 young inventors*, 2 x *Spot Awards* for Prototype of the month.
- *Best paper award* in ACM conference: IWCTS 2014.
- *Deputy Program Chair* of The International Conference on Indoor Positioning and Indoor Navigation (IPIN 2017).
- *Ranked #1 in DCASE 2018 Task 5 Challenge* in an international competition of acoustic scnene classification.

TOKYO TECHIES, JAPAN 2015 – PRESENT

DIRECTOR OF DATA SCIENCE AND ARTIFICIAL INTELLIGENCE DIVISION / TUTOR

- Teach young students, professionals, managers, and executives about Data Science and Machine Learning from Basic level to Advanced level.
- Coach and mentor young students to do research in computer science field.
- Develop strategy, lead and inspire young tutors in Data Science and Machine Learning field.

KEY ACCOMPLISHMENTS

- *1 paper to A-ranked conference* in education with a high-school student.
- Other *4 research papers* to international conference with 2 groups of high-school student.

TANGLEWOOD MUSIC SCHOOL, SINGAPORE 2010 – 2011

MARKETING EXECUTIVE

- Analyzed marketing strategy and evaluated performance through surveys and feedbacks.
- Used Microsoft CRM to analyze customer profiles, behavior, and interest to segment the market.

- Managed company's Facebook, blog, homepage, featured news, and website.
- Co-ordinated with Above1 and Oasis on security and website development and with Mileage, a public relation consulting firm, to manage the company's public image.

KEY ACCOMPLISHMENTS

- Helped Tanglewood from losing half of its students after moving to a new location in the end of 2010 to outperforming in 2011 by increasing 200% number of students.
- Developed new concepts: 3P(s) Practice – Play – Perform, emphasizing performances that help students improve not only skills but also mentality.
- Managed and organized performance and concerts such as Sydney Conservatorium of Music's recital in Singapore; *Soiree in the Park*, a public concert in Singapore's Botanic Garden, attracted more than 2000 people in the audience.

EDUCATION & TRAINING

Doctor of Philosophy – PhD Candidate, Artificial Intelligence
The University of Tokyo, Graduate School of Engineering Advanced Interdisciplinary Studies, Doctoral Program
Under training since September 2018

Master of Science, Information Technology
Carnegie Mellon University, Adelaide, Australia & Carnegie Mellon University, Heinz College, Pittsburgh, PA
Distinction Honor, GPA 3.78

Bachelor of Arts, Business Administration, Coventry University
Second Class

TECHNICAL SKILLS

Python, Java, R, Matlab
Jupyter Notebook, Azure Machine Learning Studio, Azure Notebook, SAS BI
Wordpress, Django, Git, Slack, Trello, Wunderlist

LEADERSHIP EXPERIENCE

Vice President of Student Council, Vietnam, 2004 - 2007
Chair of Organization Committee of Vote for Children's Rights, a UNICEF Campaign, Vietnam, 2006
President of Student Social Committee, Carnegie Mellon University, Australia, 2012
Founder and Captain of Forever Young Buffalo Basketball team, Japan, 2016 – Present, www.fyb-team.com

OTHER EXPERIENCE

Runner-up in SoftBank Cloud Hackathon Competition, August 2016
A smartphone app to help foreigners reserve tables in Japanese restaurant using Twilio API.
(http://www.hackathon.io/toja)

Runner-up in SoftBank Cloud Hackathon Competition, December 2016
A smart attendance checking app for event-managers using deep-learning face-recognition technology.
(http://www.hackathon.io/faceit)

Winner of Creative Software Development in the National contest, Vietnam (1999)

First runner-up winner in Hanoi's Information Technology contest, Vietnam (2005)

Consolation prize winner in the National Information Technology contest, Vietnam (2006)

LIST OF PUBLISHED PAPERS

– AS THE FIRST AUTHOR –

1) Vehicle weight estimation using smartphone's acceleration data to control overloading

Oct 5, 2015 – 22nd World Congress and Exhibition on Intelligent Transport Systems and Services

We propose an overloading control system with a novel method to estimate the vehicle weight using the sensor data from a smartphone mounted on the vehicle. The conventional method based on fixed weigh stations has limited coverage and is expensive to install and maintain. Our proposed system overcomes these limitations by using smartphones, which are portable and cheaper. A linear or polynomial regression model is created in our method using the features extracted from the vertical acceleration data and other sensor data from a smartphone to estimate the vehicle's weight. A pilot experiment for estimating a trolley's weight followed by an actual experiment for estimating a vehicle's weight were conducted to verify the feasibility of using our method. We achieved average errors ranging from 7 – 37% of the true vehicle weight. The results lead to the possibility of detecting overloaded vehicles using only smartphones that are mounted on vehicles.

See publication

(http://www.its-jp.org/wp-content/uploads/2014/07/ERTICO-ITS-2015-Programme.pdf?lipi=urn%3Ali%3Apage%3Ad_flagship3_profile_view_base%3BaDqFQ3flR3Sx46JKTaEibA%3D%3D)

2) User-friendly activity recognition using SVM classifier and informative features

Oct 15, 2015 – IEEE Indoor Positioning Indoor Navigation 2015

For accurate indoor positioning, a moving activity recognition (AR) method has been developed that is based on a smartphone's sensor data. Prior methods can only recognize moving activities if the smartphone is held in a predefined place. We propose a method that works in various holding places to increase the usability. An SVM classifier is chosen because of its strength in utilizing features. New features are added such as percentiles of acceleration, air pressure, and acceleration magnitude. We have achieved 94.3% overall accuracy in various holding places: in users' hands, belt pouches, pant back pockets, and pant side pockets.

See publication

(https://ieeexplore.ieee.org/document/7346783)

3) User-friendly heading estimation for arbitrary smartphone orientations

Nov 16, 2016 – IEEE Indoor Positioning Indoor Navigation 2016

For accurate indoor positioning, a heading estimation method that does not depend on smartphone orientation has been developed. While prior methods require the smartphone to be fixed in a certain orientation before processing, the proposed method works with the smartphone in any orientation. We utilize gyroscope data from three axes and use a low-pass filter to eliminate movement noise. Experimental results show that our method has an average error rate of just 3-5% in positioning distance for various smartphone orientations (held in the user's hand, belt pouch, side pants pocket, and back pants pocket). Using this method gives smartphone users a greater degree of freedom because they do not have to hold the device in a pre-defined orientation to obtain a reliable heading estimate.

See publication

(https://ieeexplore.ieee.org/document/7743642/)

4) Vehicle's Weight Estimation Using Smartphone's Acceleration Data to Control Overloading

Jun 2017 – International Journal of Intelligent Transportation Systems Research

We propose an overloading control system with a novel method to estimate vehicle weight using the sensor data from a smartphone mounted on the vehicle. The conventional method based on fixed weigh stations has limited coverage, and is expensive to install and maintain. Our proposed system overcomes these limitations by using smartphones, which are portable and cheaper. A multiple linear regression model is created using vertical acceleration statistical features and loading status classification as explanatory variables to estimate the vehicle's weight. A pilot experiment estimating a trolley's weight was followed by an experiment estimating an actual vehicle's weight to verify the feasibility of using our method. We achieved an average error of 593 kg, which accounted for 5.89% of the true average vehicle's weight.

See publication

(https://link.springer.com/article/10.1007/s13177-017-0145-3)

5) Experience Filtering for Robot Navigation using Deep Reinforcement Learning

Jan 2018 - Proceedings of the 10th International Conference on Agents and Artificial Intelligence - Volume 2: ICAART, 243-249, 2018, Funchal, Madeira, Portugal

We propose a stochastic method of storing a new experience into replay memory to increase the performance of the Deep Q-learning (DQL) algorithm, especially under the condition of a small memory. The conventional standard DQL method with the Prioritized Experience Replay method attempts to use experiences in the replay memory for improving learning efficiency; however, it does not guarantee the diversity of experience in the replay memory. Our method calculates the similarity of a new experience with other existing experiences in the memory based on a distance function and determines whether to store this new experience stochastically. This method leads to the improvement in experience diversity in the replay memory and better utilization of rare experiences during the training process. In an experiment to train a moving robot, our proposed method improved the performance of the standard DQL algorithm with a memory buffer of less than 10,000 stored experiences.

See publication

(http://www.scitepress.org/PublicationsDetail.aspx?ID=EwlHpGmN/zw=&t=1)

6) Automating Water Purification Plant Operations Using Deep Deterministic Policy Gradient

Jun 2018 - Joint Workshop on Deep (or Machine) Learning for Safety-Critical Applications in Engineering , ICML 2018, Stockholm, Sweden, July 14-15, 2018

Automation in water purification plants (WPPs) can help reduce the problem of expert shortage in the future, as well as optimize the cost of operation. Reinforcement learning shows potential for training a system to learn how to operate a WPP. The system can learn to make different type of decisions, such as how much water to take in to satisfy upcoming demands or how much of the chemicals to inject into raw water for treatment. While conventional

supervised-learning methods that use example data teach a system to imitate the actions of experts, a reinforcement learning system can learn the optimal actions through trial-and-error processes. We integrated this idea into a reinforcement learning algorithm, which usually has a long trial-and-error learning process, to shorten the time for learning and achieve less waste in the exploration policy. In our simulated experiments, our system uses a deep deterministic policy gradient algorithm with a supervised-learning phase at the beginning called the imitation phase, that can surpass experts when making decisions related to intake water amount with more electricity efficiency, and achieve a faster and more stable learning process.

See publication

(https://easychair.org/cfp/DISE1)

7) Applying Deep Reinforcement Learning In Operations Of Water Purification Plants

Sep 2018 - WA World Water Congress & Exhibition 2018

Automation in water purification plants can help reduce the problem of expert shortage in the future, as well as optimize the cost of operation. Reinforcement learning is a potential algorithm for training a system to learn how to operate a water purification plant. The system can learn to make different types of decisions, such as how much water to take in to satisfy the upcoming demands, or how much chemicals to inject into raw water for treatment. Unlike conventional methods that use past data in supervised learning to imitate actions of human experts, a reinforcement learning system can learn the optimal actions through trial-and-error processes. We have studied the feasibility of applying the reinforcement learning algorithm into water purification operations. In our simulated experiments, the system can surpass human experts when making decisions in intake water amount with 10% more in efficiency, and have a similar performance when making decisions in injection rate of chemicals.

– AS THE CO-AUTHOR –

1) Sensor-based trip-separation method based on ergodic HMM

Nov 04 , 2014 – 7th ACM SIGSPATIAL International Workshop on Computational Transportation Science

A novel method for extracting “trip-periods” (i.e., periods in which a subject travels) from continuously collected sensor data, called a “trip-separation method” hereafter, is proposed. There are mainly two drawbacks in previous studies that define the trip-separation problem as a problem of detecting “stay-periods” (i.e. periods in which a subject stays within an area) using a boundary of “stay-area” (i.e., an area a subject stays): false negatives caused by short-distance trips within the area and false positives caused by GPS-positioning errors. The proposed method solves these problems by the following two ideas: (1) it defines the trip-separation problem as a 2-class classification problem of trip-periods and stay-periods. This definition enables to utilize not only features of stay-periods but also those of trip-periods that contribute to robust detection of short-distance trips. Moreover, large GPS-positioning error, which is the main cause of the false positives in conventional methods, is utilized as one of the good features of stay-periods. (2) it suppresses a problem that outliers can cause in classifying each GPS point into the two classes by using a state-transition model based on a characteristic of travel-behaviors of people. The model is mathematically formulated using ergodic HMM. The experimental evaluation showed over 80% in both precision and recall rate. The proposed method was able to correctly detect short-distance trips that cannot be detected by conventional methods.

See publication

(https://dl.acm.org/citation.cfm?id=2674918.2674920)

2) City Dashboard – Utilization of smartphones' sensor data for statistical travel-behavior analysis on the basis of automatic trip-extraction technology

Jul 2015 – The 14th International Conference on Computers in Urban Planning and Urban Management

This study proposes a novel system called "City Dashboard", which utilizes smartphones' sensor data for cheaper and more frequent travel-demand survey and analysis. One of the main technical challenges is automatic extraction of the trip-information, namely, origin, destination, departure time, arrival time, and modes of transport. To achieve it, this study proposes new features derived from characteristics of sensors and characteristics of human's travel behavior. The experimental result showed that the proposed method achieved accuracy of 88.8% in extracting trip-information, which is much higher than that of the methods that only use velocity and acceleration, namely 59.2%

See publication

(http://web.mit.edu/cron/project/CUPUM2015/proceedings/Content/posters/399_ohashi_h.pdf)

3) Trip-Extraction Method Based on Characteristics of Sensors and Human-Travel Behavior for Sensor-Based Travel Survey

Jan 2016 – Journal of Information Processing Society of Japan, Vol. 24, No. 1, 39-48

A novel method for extracting "trip periods," i.e., periods in which a person travels, from continuously collected sensor data, called a "trip-extraction method" hereafter, is proposed to make a sensor-based travel-behavior survey possible. There are mainly two drawbacks in previous studies that detect "stay periods," i.e., periods in which a person stays within an area, by using the boundary of a "stay area," i.e., an area in which a person stays and then regard the rest of the periods as trip periods: false positives caused by GPS-positioning errors and false negatives caused by short-distance trips within the boundary. This study solves these problems by using novel features that are effective even in the case where the GPS-positioning error is large and by classifying every single piece of GPS data into either trip periods or stay periods not on the basis of the stay-area boundary but on the newly proposed features. An experimental evaluation showed that the precision of the proposed method was 89.4%, which is much higher than that of conventional methods.

See publication

(https://www.jstage.jst.go.jp/article/ipsjjip/24/1/24_39/_article)

4) Hierarchical Model for Zero-shot Activity Recognition using Wearable Sensors

Jan 2018, Proceedings of the 10th International Conference on Agents and Artificial Intelligence - Volume 2: ICAART

We present a hierarchical framework for zero-shot human-activity recognition that recognizes unseen activities by the combinations of preliminarily learned basic actions and involved objects. The presented framework consists of gaze-guided object recognition module, myo-armband based action recognition module, and the activity recognition module, which combines results from both action and object module to detect complex activities. Both object and action recognition modules are based on deep neural network. Unlike conventional models, the proposed framework does not need retraining for recognition of an unseen activity, if the activity can be represented by a combination of the predefined basic actions and objects. This framework brings competitive advantage to industry in terms of the

service-deployment cost. The experimental results showed that the proposed model could recognize three types of activities with precision of 77% and recall rate of 82%, which is comparable to a baseline method based on supervised learning.

See publication

(http://www.scitepress.org/Papers/2018/65952/)

5) Augmenting Wearable Sensor Data with Physical Constraint for DNN-Based Human-Action Recognition

Aug 2017, Time Series workshop at International Conference of Machine Learning (ICML)

A novel data augmentation method suitable for wearable sensor data is proposed. Although numerous studies have revealed the importance of the data augmentation to improve the accuracy and robustness in machine-learning tasks, the data augmentation method that is applicable to wearable sensor data have not been well studied. Unlike the conventional data augmentation methods , which are mainly developed for image and video analysis tasks, this study proposes a data augmentation method that can take an physical constraint of wearable sensors into account. The effectiveness of the proposed method was evaluated with a human-action-recognition task. The experimental results showed that the proposed method achieved better accuracy with significant difference compared to the cases where no data augmentation is applied and where a couple of simple data augmentation is applied.

See publication

(http://roseyu.com/time-series-workshop/submissions/TSW2017_paper_9.pdf)

6) MULTICHANNEL ACOUSTIC SCENE CLASSIFICATION BY BLIND DEREVERBERATION, BLIND SOURCE SEPARATION, DATA AUGMENTATION, AND MODEL ENSEMBLING

Detection and Classification of Acoustic Scenes and Events (DCASE) 2018 Challenge Task 5 can be regarded as one type of multichannel acoustic scene classification. The important characteristic of the Task 5 is that a microphone array may be put at different locations between the development dataset and the evaluation dataset, so we should not exploit location-dependent spatial cues but location-independent ones to avoid overfitting. The proposed system is a combination of front-end modules based on blind signal processing and back-end modules based on machine learning. To avoid overfitting, the front-end modules employ blind dereverberation, blind source separation, etc., which use the spatial cues without machine learning. The back-end modules employ one dimensional-convolutional-neural-network-(1DCNN)-based architectures and VGG16-based architectures for individual front-end modules, and all the 89 probability outputs are ensembled.

http://dcase.community/documents/challenge2018/technical_reports/DCASE2018_Tanabe_55.pdf