Jiabo Xu

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EDUCATION BACKGROUND

The Australia National University (ANU), Australia 07/2017 – 12/2019
M.S. in Computing (Specializing in Artificial Intelligence) | Overall GPA: 5.5/7.0

Macau Polytechnic Institute (MPI), Macao 08/2013 – 06/2017
B.S. in Computing | Overall GPA: 3.3/4.0

Core Courses: Discrete Mathematics / Statistics I&II / Data Structures and Algorithms / Individual Computing Project / Statistical Machine Learning / Advanced Topics in Machine Learning / Computer Vision / Advanced Topics in Computer Vision / Artificial Intelligence / Document Analysis / Bio-inspired Computing / Software Engineering / Digital Image and Video Processing / Computer Security / Data Warehousing and Data Mining / Computer Architecture / Operating Systems

PUBLICATIONS

- **Xu, J. (Presenter)**, Anwar, S., Barnes, N., Grimpen, F., Salvado, O., Anderson, S., Mohammad, A. (2020) *OfGAN: Realistic Rendition of Synthetic Colonoscopy Videos*, The 23th International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), Oct. 2020, Lima, Peru.
- Cheong, S. T., **Xu, J.**, Liu, Y. (2017) *Design of Web Crawlers for Constructing an Efficient Chinese-Portuguese Bilingual Corpus System*, The 16th International Conference on Electronics, Information, and Communication (ICEIC)

SKILLS

Programming & Software: Python | JavaScript | HTML | CSS | MySQL | MongoDB | Apache | Nginx | Android | Latex
Computation Platforms: Linux | Google Cloud | AWS | Slurm
Libraries: Scientific Computing (NumPy, SciPy) | Data Manipulation (Pandas) | Machine Learning (Scikit-Learn, PyTorch, Keras, TensorFlow) | Visualization (Matplotlib, Seaborn) | Web Crawler (PySpider)

RESEARCH EXPERIENCES

OfGAN: Realistic Rendition of Synthetic Colonoscopy Videos
Research Assistant, ANU / CSIRO | Advisor: Ali Armin, Saeed Anwar, Nick Barnes 03/2019 – 12/2019

- Develop an Optical Flow Generative Adversarial Network (OfGAN) model to transform simulated colonoscopy videos into realistic ones while preserving annotation, focusing on using a cycle-consistent structure and optical flow for both spatial and temporal consistency via adversarial training.
- Systematically validated the OfGAN with a synthetic dataset and published CT datasets, and demonstrated the model's advantages, including 1) enhanced realistic level of the transformed video, 2) strictly enforced preservation of the annotation (e.g., source video's optical flow) in the transformed video, and 3) supreme robustness to noise.
- Benchmarked the OfGAN against the baseline method through both qualitative and quantitative evaluation.
- A first-author research article presented in the 2020 MICCAI.
- Project sponsored by CSIRO's Data61, Australia's data innovation network that transforms existing industries and creates new ones through the application of science and technology.

Crude Oil Identification on Ocean from Satellite Images
Research Assistant, CSIRO | Advisor Lars Petersson 10/2019 – 11/2019

- Achieves very high accuracy on the supervised binary classification of overlooking pictures:
  - Leveraged 4000 labeled overlooking pictures captured by our lab and augmented them with various noises.
  - Fine-tuned the pretrained EfficientNet-BX and Resnet-X and searched hyperparameters with Genetic Algorithm.

Designed a time-based Genetic Algorithm, considering both continuous (learning rate, momentum) and discrete (model, optimizer, data augmentation method) hyperparameters; the superior model attained over 95% classification accuracy on the test set.

Deep Texture and Structure Aware Filtering Network for Image Smoothing
Research Assistant, ANU | Advisor: Nick Barnes 09/2018 – 12/2018

- Led a team of two to build a deep texture and structure aware filtering network for image smoothing so as to retain salient structures and remove insignificant textures in computer vision:
  - Designed, trained and validated a texture prediction network (TPN) for predicting the location and magnitude of textures.
  - Generated a sizable dataset by blending natural textures with clean structure-only images in support of TPN model construction.
  - Combined TPN with a semantic structure prediction network (SPN) to establish the texture and structure aware filtering network (TSAFN) so as to remove texture awareness and preserve structure-awareness.
  - Demonstrated the new model's advantage in distinguishing textures and structures with similar low-level appearance.
  - Leveraged Google Cloud to handle the computationally intensive tasks.

Length-Based Sentence Alignment for Chinese-Portuguese Translation
Research Assistant, MPI | Advisor: Xiaodi Cheong 09/2016 – 05/2017

- Leveraged greedy search method to enable sentence alignment on Chinese-Portuguese with the absence of prior knowledge in both languages and an interactive bilingual text cleaning platform.
- Deployed the workflow to the MPI Chinese-Portuguese-English Machine Translation Laboratory to enable efficient bilingual text crawling.

COURSE PROJECTS

***Bio-inspired Computing* Course Project, ANU** 03/2018 – 05/2018

- Implemented the Ant Colony Algorithm (ACA) and Genetic Algorithm (GA) on both optimization and hyperparameter tuning of shallow CNN on the CIFAR-10 classification task:
  - Designed the ACA and the GA on both continuous and discrete solution space, consisting of parameter optimization and hyperparameter tuning respectively.
  - Analyzed the performance among the ACA, the GA and gradient-based methods on parameter optimization.
  - Analyzed the performance among the ACA, the GA and the random grid search on hyperparameter tuning.
  - Optimized the time consumption with better search strategies and evolutional methods for continuous solution space.
  - Imported efficiency, the reduction of loss within the time interval, as another fitness for measurement.

***Computer Vision* Course Project, ANU** 03/2018 – 05/2018

- Empirically characterized the performance of FCN and U-Net deep learning models on semantic segmentation:
  - Leveraged KITTI vision benchmark dataset to drive analysis; systematically loaded data, trained models, evaluated performance, and visualized results; utilized AWS GPU spot instances to drive the computation.
  - Performed image preprocessing to reduce dataset size and boost computational efficiency while preserving the quality of training.
  - Designed a hybrid model based on integrating FCN and U-Net, focusing on reducing the number of parameters and promoting the prediction accuracy; attained an intersection over union (IoU) score above 30%.

***Document Analysis* Course Projects, ANU** 08/2017 – 11/2017

- Systematically studied information retrieval, graphical models, HMM, CRF, NER, word-embedding, sentimental analysis, topic models, etc, and their applications for text mining.
- Reimplemented word-embedding models, FastText and Word2Vec, and employed word-embedding for sentimental analysis in Tensorflow.

***Digital Image and Video Processing* Course Project, MPI** 02/2016 – 05/2016

- Implemented an array of digital image processing algorithms in MATLAB, including:
  - A workflow for generating hybrid images with an interpretation that changes with viewing distance, covering a standard 2D Gaussian filter and an impulse filter minus the Gaussian filter for low-pass and high-pass filtering, respectively.
  - An image quilting algorithm for texture synthesis and transfer.
  - The Poisson Blending algorithm for blending an object or texture from a source image into a target image seamlessly.
  - A face morphing algorithm based on triangulation of face images and affine transformation on triangle pairs.

Two algorithms for colorizing gray-scale images based on quadratic cost function optimization and matching luminance and texture information between the images, respectively.

EXTRACURRICULAR ACTIVITIES

Kaggle Challenge: Global Wheat Detection 06/2020

- Built a deep learning model in PyTorch, JupyterLab and Google Cloud to estimate the number and size of wheat heads based on outdoor field images of wheat plants, covering a wide range of unseen genotypes, environments, and observational conditions:
  - Leveraged CutMix, Mixup, mosaic, and jigsaws algorithms to preprocess images.
  - Employed YOLOv5 real-time object detection system in PyTorch to perform wheat detection.
  - Employed Google's EfficientDet-D5 algorithm to perform wheat detection, which includes 1) a weighted bi-directional feature pyramid network for easy and fast multiscale feature fusion, and 2) a compound scaling method that uniformly scales the resolution, depth, and width for all backbone, feature network, and box/class prediction networks
  - Enabled iterative update of network weights with the Adam optimizer; controlled the learning rate using the cosine annealing algorithm.
  - Tuned hyperparameters via cross validation and Bayesian optimization.
  - Utilized multiple variants of non-maximum suppression (NMS) algorithms to merge detections tied to a given object, covering batchesnms, softnms, normalnms, and mergenms.
  - Compared the model's predictive capability between YOLOv5 and EfficientDet-D5.

Computer Vision Based Urban Farming System Using Machine Learning 03/2020

- Designed an urban farming system, which, based on computer vision and artificial intelligence, can automatically monitor crop health and prevent pest infestations; key components include:
  - Collected 1K+ images of infested crop from a local farmland; built an annotation program to identify and label regions of interest in the collected images.
  - Built, trained and validated a Single Shot MultiBox Detector (SSD) deep learning model to enable real-time pest detection; demonstrated the algorithm's superiority to conventional CNN in terms of speed and accuracy.
  - Optimized the developed model, covering multi-leaf detection within a frame, improvement of mean average precision, and the expansion of crop/pest categories.

Kaggle Challenge: TGS Salt Identification 09/2019 – 11/2019

- Built, trained, validated and tested a machine learning model for identifying the subsurface TGS salt based on seismic images:
  - Performed data preprocessing to enhance data quality; employed various deep learning algorithms (CNN, U-net, Xception, ResNet34) in scikit-learning library to enable image recognition.
  - Optimized model parameters associated with loss function, optimizer, batch size and cross validation.
  - Used urllib and BeautifulSoup libraries to scrape websites for additional data; used Flip and Gaussian Blur algorithms to preprocess images for enhancing training set, leading to enhanced recognition flexibility and robustness.