Jun Liu
https://chrisluu.github.io
Email : jun.liu@cnu.edu.cn
Mobile : +86-181-7456-4659

Education

- **Capital Normal University** — School of Mathematical Sciences
  Master of Applied Statistics — *Sep. 2014 – Jun. 2017*
  - **Primary Courses**: Optimization Theory and Algorithm; Data Structure; Numerical Analysis; Digital Image Processing; Computer Graphics; Pattern Recognition And Machine Learning, etc.
- **Hunan Institute of Technology** — School of Computer Science and Technology
  Bachelor of Computer Science And Technology — *Sep. 2009 – Jun. 2013*
  - **Primary Courses**: C/C++ Programming; Data Structure; Computer System; Computer Theory; Discrete Mathematics; Probability Statistics; Linear Algebra, etc.

Work Experience

- **PingAn Technology, Inc** — Shenzhen, China
  Deep Learning Algorithm Engineer — *Mar. 2019 - Present*
  - **Classification of Benign and Malignant Breast Tumors in Ultrasound Images**: Breast cancer is a health problem for women worldwide. Ultrasound has become a useful adjunct modality for breast tumor diagnosis because it is cost-effective, noninvasive, and performed in real-time. However, certain inherent characteristics of ultrasound images, including low contrast, speckle noise, and tissue-related textures, may cause difficulties for radiologists. I designed a classification algorithm to predict benign and malignant features of breast tumors. The algorithm, which is based on cutting-edge AI technologies, mainly consists of two parts: a feature encoder and an attention module for training guidance. Focal Loss was selected to alleviate the severe class imbalance between benign and malignant samples. I choose densenet121 as Baseline which scored AUC 0.89 and ACC 0.8276 on our test dataset which contains 938 nodules 334 patients, respectively. I continually improved the evaluated score to AUC 0.92 and ACC 0.8861 by customizing the model architecture according to the specialties of the breast ultrasound image.
  - **PaicLabelTool**: Built a CS backend software for labeling medical images. The software is so-called PaicLabelTool, which is well designed for labeling multi-modality medical images, such as thyroid ultrasound image, breast mammography image, and breast ultrasound image, and it's very easy to be extended to other modal images. PaicLabelTool is based on LabelMe which is an open source software for labeling natural images. I redefined PaicLabelTool as an MVC software which mainly includes six modules, Tool Bar module, Canvas module, Patient Diagnosis Information module, Annotation List module, File Tree Widget module, and the last one is the AI module. Doctors can select different tools from the Tool Bar module, such as polygon, rectangle, and curve, to labeling the lesions and a JSON format file with a mask file in PNG format will be saved automatically when doctors click the save button. I also designed a multi-view canvas for displaying breast mammography image which usually contains L-CC, R-CC, L-MLO, and R-MLO views. I extracted diagnosis information from pathological diagnosis Excel table and compressed the information into an NPY format file. Qt-based Multi-Thread Class is designed for loading the compressed NPY file automatically when the software is launched and the corresponding modal is selected. Doctors can manipulate annotations in the Annotation List module, once annotation in the List module is selected and the corresponding delineation in the canvas is selected automatically. Doctors can import files from a directory and the files in the directory will be structured according to two conditions which are patient ID and check date. The AI module which can output AI results automatically, so PaicLabelTool is actually a semi-automatic labeling tool, doctors can make adjustments based on AI results, thus we improved the efficiency of labeling and reduced the heavy manual works.
- **Kaggle** — Shenzhen, China
  Competition Expert — *Nov. 2018 - Present*
  - **RSNA Intracranial Hemorrhage Detection – Multi-Class Segmentation**: Intracranial hemorrhage, bleeding that occurs inside the cranium, is a serious health problem requiring rapid and often intensive medical treatment. For example, intracranial hemorrhages account for approximately 10% of strokes in the U.S., where stroke is the fifth-leading cause of death. Identifying the location and type of any hemorrhage present is a critical step in treating the patient. I built an algorithm to detect acute intracranial hemorrhage and its subtypes. Specifically, I constructed an Unet-like model using a pre-trained ResNet34 as an encoder and output 6 channels score map for identifying 6 different subtypes. There are 4516818 slices and 727392 slices in the training dataset and test dataset, respectively. This competition is evaluated using a weighted multi-label logarithmic loss and I got stage2 Private LB: 0.05571, ranking *top*6%(76/1345). Please click Bronze Medal for more details.

- **SIIM-ACR Pneumothorax Segmentation**: Pneumothorax is usually diagnosed by a radiologist on a chest X-ray, and can sometimes be very difficult to confirm. I designed a convolution neural network which consists of a classic Encoder-Decoder structure to segment the lesion of pneumothorax from X-ray image. After data analysis, I found that there is a severe class imbalance problem. The ratio of negative samples to positive samples is 2.5, this will greatly affect the segmentation of positive samples. Two main strategies were used to alleviate the aforementioned problem. In each training epoch, the ratio of negative samples to positive samples remains $1:1$, that is to say, the negative samples were randomly selected as the number of positive samples, so the data was well balanced before feeding into neural network. A weighted sum of Focal Loss and Dice Loss was designed as a mixed Loss function. There are 12047 patients and 3205 patients in the training dataset and test dataset, respectively. This competition is evaluated on the $Mean\ Dice\ Coefficient$ and I got stage2 Private LB: 0.8410, ranking $top7\%(96/1475)$. Please click Bronze Medal for more details.
- **Humpback Whale Identification – Few-Shot Fine-Grained Classification**: Humpback whale identification is an Open Set Few-Shot Fine-Grained image classification problem, which includes 5005 different whale classes. Especially, an unknown class exists, named the new class. Metric learning was selected to address this extremely hard task. Specifically, according to the specialty of the whale tail image, I decided to do pose alignment for tail by landmarks to reduce the difficulty of the problem. For the feature encoder part, a modified densenet121 was used to extract features from the aligned whale tail image. Refer to ArcFace which is SOTA, I implemented Additive Angular Margin Loss in Mxnet and this loss function further improved the final results. Finally, cosine similarity was computed to assign the class ID for each image in the test dataset. There are 25361 images and 7960 images in the training dataset and test dataset, respectively. This competition choose $Mean\ Average\ Precision@5(MAP@5)$ as evaluation metric, and I got Private LB: 0.928, ranking $top4\%(64/2129)$. Please click Silver Medal for more details.
- **Human Protein Atlas Image Classification – Multi-Task Recognition**: Human Protein Atlas Image Classification is a competition held by Kaggle, which is aim to classify subcellular protein patterns in human cells. It's a multi-label classification problem, that is to say, each sample may have multiple possible labels. There are 28 different types of proteins in microscope images. This competition is evaluated on the macro F1 score. ResNet50 was selected as backbone which is customized for fine-grained image classification problem. Specifically, the final features used for classification were concatenated different features from different layers. There is a severe class imbalance problem in the training dataset. In order to alleviate the aforementioned problem, I designed a loss function which is based on Focal Loss to accommodate multi-label classification task. There are 31072 images and 11702 images in the training dataset and test dataset, respectively. This competition is evaluated on macro F1 score and I got Private LB: 0.539, ranking $top2\%(41/2169)$. Please click Silver Medal for more details.

- **Imsight Medical Technology, Inc** Shenzhen, China
  Algorithm Engineer *Sep. 2017 - Mar. 2019*
  - **Pulmonary Nodule Type Classification**: Pulmonary Nodule Type Classification is a fine-grained image classification problem. The difficulty in this problem is that large intra-class variance and small inter-class variance. For example, the shape and texture of same type of nodule vary largely and different type of nodule display high visual similarity. The discriminative differences only exist in some subtle regions. Model should be well designed with the ability to catch subtle discriminative regions for accurate classification. Pulmonary Nodules can be classified into four classes: Ground-Glass, Part-Solid, Solid, and Calcification. As the most common type, Solid nodules exceed 50% of the whole dataset, thus, there is also a severely class imbalance problem. The well-trained model got an accuracy of 92% on my test dataset with more than 3000 nodules.
  - **Nodule Template Matching**: Nodule Template Matching algorithm is aimed to detect the same nodules in different series of follow-up images. I designed an effective, fast and accurate algorithm and implemented it in modern c++11. I built a test dataset that contains 25 patients with more than 500 nodule pairs and I got ACC over 99.6%. Moreover, I do extremely optimized the Pipeline with a result that it can predict a pair of nodules within 10ms tested on the device with i7-7700k CPU.
  - **Lung-Sight**: Build a stable CS software called Lung-Sight which is a developed lung cancer screening system with the cutting-edge AI technologies. Lung-Sight is designed for conveniently display the outputs generated by Lung Cancer Engine which can predict pulmonary nodules and analyze features automatically with the power of AI. The Medical Image displaying and manipulation system is based on ITK, VTK and Qt, OpenGL as well, which can communicate fluently with PACS in hospital, thus, we extend the normal image viewer system. It's worth mentioning that I won considerable bonus since I complete this project in such a short time but without compromising its high levels performance and robustness.

- **Shenzhen Institutes of Advanced Technology** Shenzhen, China
  Research Assistant *Jul. 2017 - Sep. 2017*
  - **Blood Vessel Planar Parameterization**: Blood Vessel Planar Parameterization is a visualization part of Robotic Catheter System for Cardiovascular Interventions which is support by The National High Technology

Research and Development Program of China(863 Program). Our algorithm is based on rotation minimizing frame(RMF) which is widely used in computer graphics. Some of our experimental results can be found here.

- **Samsung Electronics (China)R&D Center** Beijing, China
  Deep Learning Algorithm Intern *Sep. 2016 - Nov. 2016*
  - **Text Image Synthesis** : In this work, we Built a fast and scalable engine to generate synthetic images of text in clutter. This engine overlays synthetic text to existing background images in a natural way, accounting for the local 3D scene geometry. Thus, we synthesize large-scale training samples for text localization in natural images. The algorithm behind the engine can be divided into three parts: Segmentation of background images, Depth estimation for 2D images, Image synthetic algorithm. Specifically, I finished segmentation part.
- **Intel Labs China** Beijing, China
  Algorithm Intern *May. 2016 - Sep. 2016*
  - **Expression Transfer Based On 3DMM**: Reconstruct 3D human face from a single 2D image based on a 3DMorphable Model(3DMM), including estimate head's pose, face shape and face expression coefficients, etc. With predefined 68 3D Landmarks on 3DMM and detected 68 2D key points of the 2D image, we construct 68 2D-3D landmark pairs and use Gauss-Newton to optimize the distance between 3D-2D points by projecting 3D landmarks on to the 2D image. Once we finish 3D face reconstruction, face editing like expression variation could be done with the instruction of reconstructed 3D face. For example, a different facial expression could be easily transferred onto the face of the 2D image without losing its identity.
  - **Face Frontalisation**: Frontalisation is the process of synthesizing frontal facing views of faces appearing in single unconstrained photos. Our method produces a new face image of frontal views which can be used for face recognition and other purposes.
- **Xuexibao** Beijing, China
  Algorithm Intern *Feb. 2015 - Mar. 2016*
  - **Convert Whiteboard Content into an Electronic Document**: This project aims at converting the content on a physical whiteboard, captured by a digital camera, into an electronic document which can be easily manipulated as drawings in a MS Office document. Through a series of image processing procedures, the originally captured image is transformed into a rectangular bitmap with clean white background.

Awards

- **Single Scholarship**: Feb. 2015 CNU
- **National Grants**: Oct. 2014 CNU
- **National Scholarship**: Oct. 2011 HNIT
- **Third Prize In Science And Technology Competition For College Students**: Jun. 2011 HNIT
- **National Scholarship**: Oct. 2010 HNIT

Programming Skills

- **Languages**: C/C++, Python, Java, Matlab, etc.
- **Deep learning frameworks**: Keras, Pytorch, Gluon, Mxnet, Tensorflow, etc.
- **Medical Image related libraries**: SimpleITK, Nibabel, Pydicom, ITK, VTK, etc.
- **CG&CV related libraries**: OpenGL, OpenCV, CGAL, etc.
- **Linear Algebra optimization libraries**: Armadillo, Eigen, Ceres, etc.