Deep Learning Techniques for Medical Image Processing & Analysis

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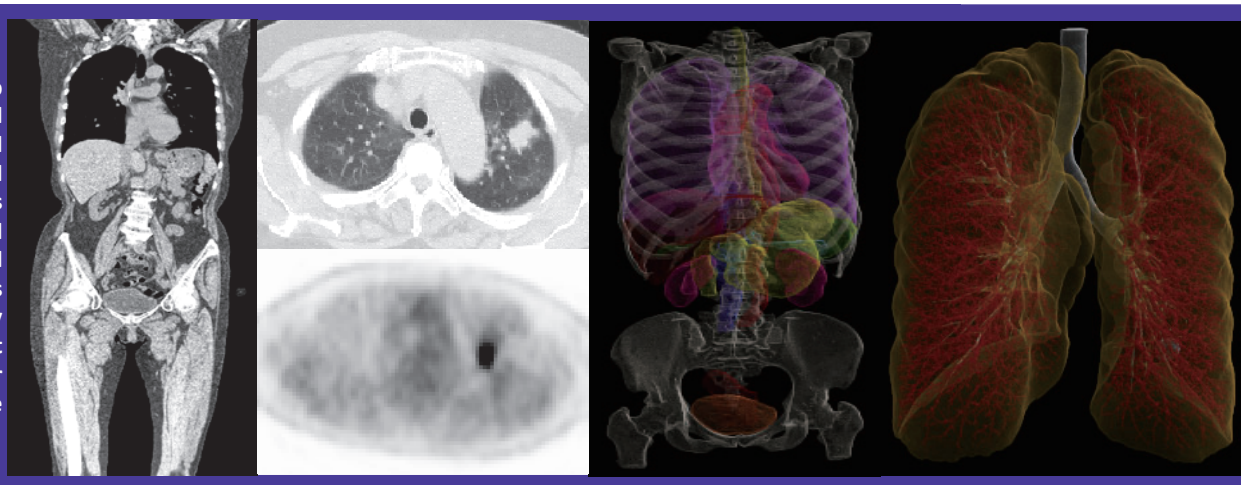
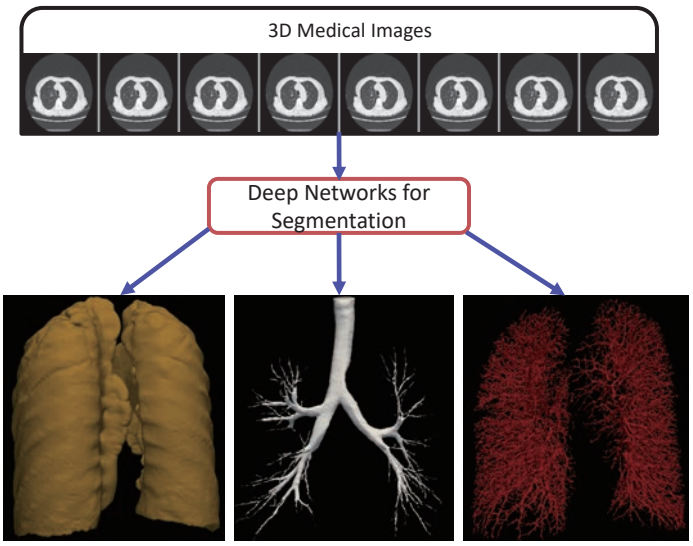
Abstract

With quick evolution of deep learning techniques, medical images can be processed and analyzed more efficiently and precisely. These new techniques provide powerful tools that would make revolution for clinical diagnosis and treatment. In this poster, we introduce four recently developed techniques that exploit deep learning techniques for intelligent medical image processing and analysis.



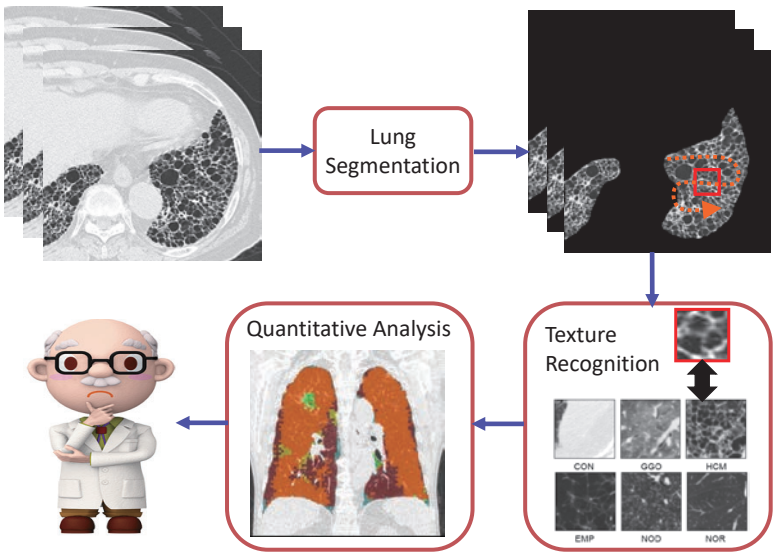
Intelligent Anatomical Analysis on 3D Medical Images

- Anatomical Analysis on Medical Images is Crucial for Computer-Aided Diagnosis
- Deep Networks Based Segmentation for Anatomical Analysis
- Precise Segmentation of Organs and Tissues from 3D Medical Images



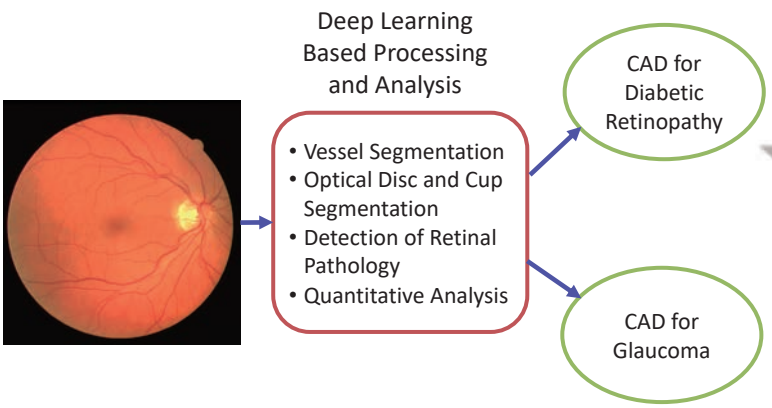
Intelligent Diagnosis for Diffuse Lung Diseases by Deep Networks

- Segmentation of Lungs with Diffuse Opacities by a Fully Convolutional Network
- Automatically Recognize Pulmonary Textures by a Multi-Scale Attention Network
- Quantitative Analysis to Provide Diagnostic Information for Radiologists



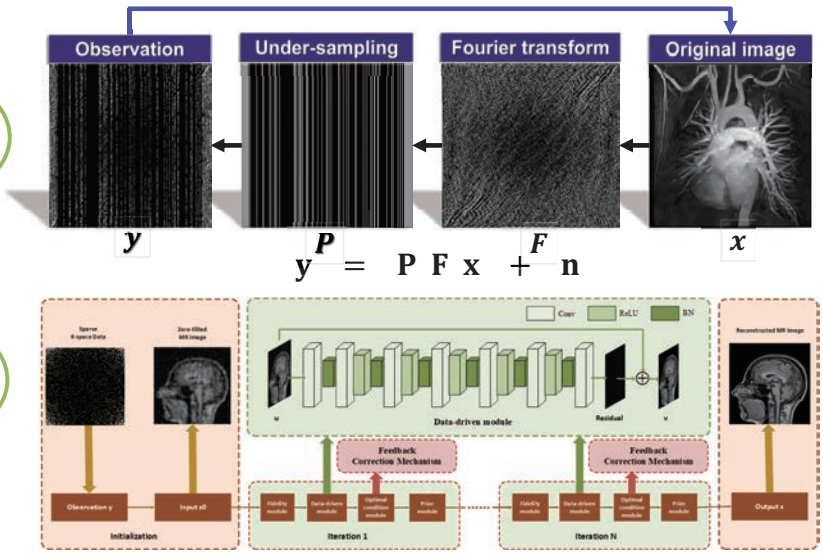
Intelligent Diagnosis for Retinal Images by Deep Networks

- Precise Segmentation of Retinal Anatomical Structures on Fundus Images
- Retinal Pathology Detection and Recognition for Quantitative Analysis
- Computer-Aided Diagnosis for Diabetic Retinopathy and Glaucoma



Deep Learning for Enhancement of MR Images

- Reconstruct the fully-sampled MR images from sparse k-space data
- Reject improper outputs and direct the sequence to converge to desired solutions
- Simultaneously remove Rician nosies in practical MR imaging process



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Advanced Driver Assistance System and VR/CG based Digital Archives

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Abstract

We introduce two studies conducted by Dalian University of Technology and Ritsumeikan University. (1) On-board stereo camera for advanced driver assistance system (ADAS), and (2) digital museums of cultural and artistic resources using virtual reality and computer graphics. The former focuses on binocular stereo vision and the development of vision-based ADAS solutions. The later focuses on digital archives of and exhibition techniques for the "objects" and "events" concerning the traditional cultural heritages in Kyoto, using the latest technologies of high-precision 3D modeling, acoustic digital archiving, high-realistic sound filed recording and reproduction, visuo-haptic modeling, immersive display, and virtual reality.

- The advanced driver assistance system(ADAS) uses a variety of sensors installed in the car to sense the surrounding environment, collect data, identify, detect and track static and dynamic objects, and combine navigation maps data, perform systematical calculation and analysis, so that the driver can detect the danger that may occur in advance, and effectively increase the comfort of driving the car.

Demand for Visual Cameras in Automotive

- In the automotive market, ADAS sensors has the potential to yield significant benefits for ADAS and autonomous driving applications. As we approach autonomous vehicles, the demand for all kinds of ADAS sensors is growing significantly and will continue to grow.
- Among all kinds of ADAS visual sensors, camera has the greatest demand which growing fastest as well.
- We focus on the development of vision-based ADAS solutions.

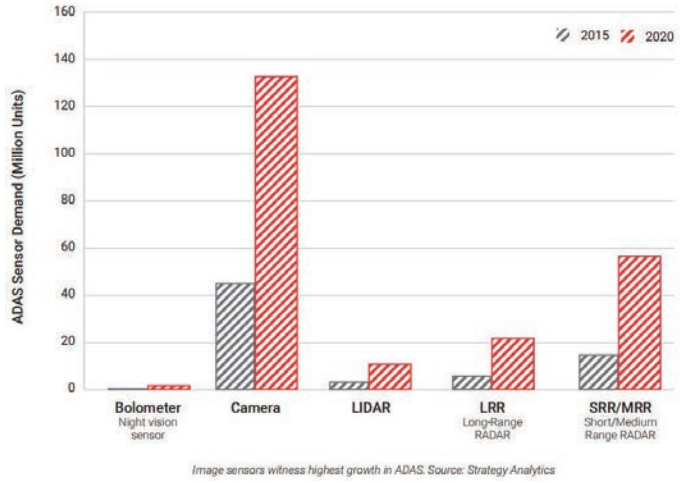
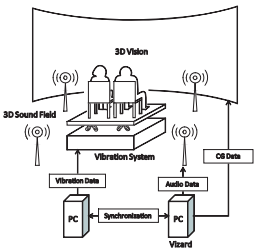


Image sensors witness highest growth in ADAS. Source: Strategy Analytics

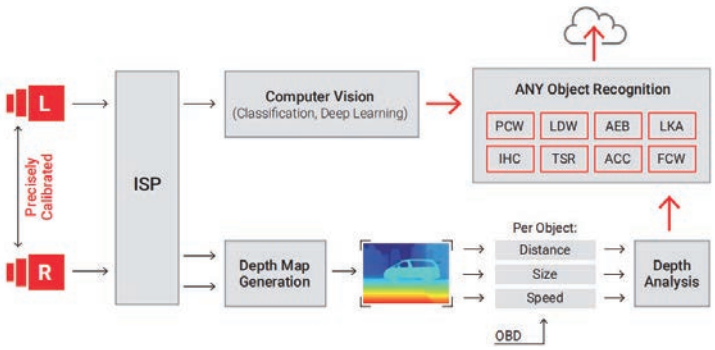
Virtual Cultural Heritage Experience System with Vibration Simulation

- We aimed to develop a digital museum to preserve and represent an intangible cultural heritage in Kyoto: the Yamahoko Parade of the Gion Festival. We designed an immersive virtual reality environment using the latest information technologies of three-dimensional computer graphics, motion capture, and high-quality sound recording.
- Users can virtually experience the vibration of the float, as well as the overall atmosphere, of the Yamahoko Parade from the viewpoint of the parade crew. The rolling and vibration of the Fune-hoko were reproduced using a 6-DOF vibration system.



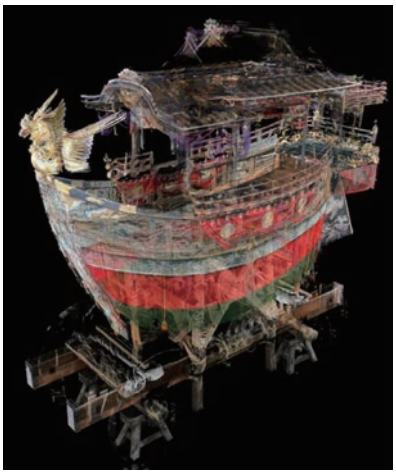
System Architecture

- Capture two video streams on the image sensors and process them by ISP.
- Generate a detailed depth map using the created disparity maps, and deep learning is applied for image classification in the same step.
- Depth maps and vehicles' information obtained from OBD such as speed and steering are used to calculate the basic information of each object in the image, and then depth analysis is performed.
- Recognize any object using the results of classification and depth analysis.
- Given the rigorous calibration process, each object in the Field of View(FoV) is given accurate distance, size, and speed measures, which in turn trigger the car's main System on Chip(SoC) to warn or avoid such objects.



See-Through Visualization of Large Scale Point Clouds

- Precise 3D see-through imaging, or transparent visualization, of the large-scale and complex point clouds acquired via the laser scanning of 3D cultural heritage objects.
- Based on a stochastic algorithm and directly uses the 3D points, which are acquired using a laser scanner, as the rendering primitives.
- For large scale point clouds consisting of more than 10^8 3D points, the pre-processing requires only a few minutes, and the rendering can be executed at interactive frame rates.
- The opacity of each laser-scanned object is flexibly controllable.



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