H114 Deep Learning on Volumetric Radiologic Imaging Datasets for Forensic Pathology Investigations

Summer J. Decker, PhD, University of South Florida, Tampa, FL 33606; Lars C. Ebert, PhD*, University of Zurich, Zurich CH-8057, SWITZERLAND; Jonathan M. Ford, PhD, University of South Florida, Tampa, FL 33606-3571; Akos Dobay, PhD, University of Zurich, Zurich CH-8057, SWITZERLAND; Natalie L. Adolphi, PhD, Center for Forensic Imaging, Albuquerque, NM 87131; Kurt B. Nolte, MD, Office of Medical Investigator, Albuquerque, NM 87131-0001*

Learning Overview: After attending this presentation, attendees will understand: (1) the concepts of Artificial Intelligence (AI) and Deep Learning (DL), (2) the hardware and software needs, (3) the potential impact of automated analysis on Postmortem Computed Tomography (PMCT) imaging, and (4) the greater role AI algorithms such as DL will play for forensic pathology in the future.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the potential utility of DL as an automated triage tool for PMCT.

Traditionally, Forensic Pathologists (FP) perform an external examination, then document internal pathologies via the autopsy. Imaging modalities, such s PMCT, can establish the cause of death in certain types of cases and better elucidate specific traumas. Postmortem medical imaging also has the added value of helping with teaching, expert witness demonstration, quality control, and telemedical consultation. The flexibility of medical imaging can assist an already-overtaxed Medical Examiner (ME) system as either a tool for triaging cases or supplementing the autopsy process. The growing opioid crisis in the United States has dramatically increased the number of autopsies needed and threatens National Association of Medical Examiners (NAME) accreditation compliance for many offices based on excessive workload. Pathologists attempting to accommodate these expanded caseloads without adequate support can become fatigued and prone to error.

While PMCT can significantly reduce the burden on offices, FPs still may not have adequate time to search for more routine but tedious findings, such as the thorough detection of bone fractures or volume estimation of organs. To further reduce time and costs for interpreting images generated, assistance systems for image reading are required. Current advances in clinical radiology are being made toward adopting DL for patient care. Studies are showing the impact of DL in areas such as the identification of lung nodules and automated brain tumor segmentation. Similar studies must be undertaken to enable use of this technology with respect to forensics. As postmortem scans have unique findings that do not occur in images from living patients, existing DL techniques will require some modifications. Postmortem imaging datasets tend to be larger, have a greater number of images and different scanning protocols, detect different pathologies and artifacts in addition to other complications, such as decomposition and extensive polytrauma.

Clinical radiology has already made significant headway in leveraging DL as a triage and first-pass diagnostic tool. However, medicolegal postmortem scanning has unique requirements and, consequently, specific algorithms need to be created. This presentation will demonstrate the use and potential value of DL in analyzing, screening, and triaging PMCT scans to evaluate its potential as a forensic tool. This presentation will provide examples of how a DL workflow is set up as well as representative examples of how DL can tackle specific forensic pathology problems.

As forensic pathologists in the United States continue to adopt advanced radiologic imaging, tools such as DL need to be in place to improve the overall throughput of the medicolegal death investigative process. AI and DL have the potential to address the diagnostic questions facing forensic pathologists in the United States and worldwide.

Forensic Pathology, Deep Learning, Radiologic Imaging