Artificial Intelligence and Point-of-care Ultrasound

Niko Pagoulatos, PhD
COO, EchoNous Inc.
Nov 9th, 2018
Critical Care Canada Forum
Definitions

AI
The science and engineering of making intelligent machines

Machine Learning
The science and engineering of enabling machines to learn without being explicitly programmed

Deep Learning
One of the most promising machine learning approaches
High-Impact AI Applications

- Self-Driving Cars
- Recommendation Systems
- Face Recognition
- Voice Assistants
- Healthcare
Catalysts for Recent AI Success

AI Algorithm Improvements + Exponentially Growing Computing Capacity + Massive Amounts of Data = AI Successful Applications
Artificial Neural Networks (ANN)

Perceptron = Node

Network of Nodes
Recognizing Handwritten Digits
Deep Neural Networks: Multiple Layers & Nodes

input layer           hidden layer 1  hidden layer 2  hidden layer 3           output layer
Convolutional Neural Networks (CNNs)
CNN to Detect & Localize Entities in Images
AI can be the catalyst towards POCUS large-scale expansion and widespread ultrasound adoption and usage
Ultrasound Adoption Approaching an Inflection Point

- 2018
- PRIMARY CARE
- ACUTE-CARE POCUS TAKES OFF
- MED SCHOOLS
- OB, GYN, RAD, CARD
- AMA 1999 Resolution

AI to drive large-scale adoption
AI Benefits for POCUS

- Significant Reduction of Learning/Confidence Curves
  - Easy to learn – Easy to use

- Wide User Base
  - All-care providers can perform specific clinical assessments

- Efficiency
  - Automation to perform clinical assessments quickly and accurately

- Potential to improve sensitivity and specificity of clinical assessments
  - Over time AI algorithms trained on massive amounts of data will become increasingly intelligent
A Framework for Applying AI to POCUS

Image Acquisition

Image Recognition & Interpretation

Clinical Decision Support
A CNN Developed to Recognize the Urinary Bladder
Common CNN Development Approach: Supervised Learning

Clinical Site 1
- Original Data
- Deidentified Data
- Conditioned formatted data

Clinical Site 2
- Original Data
- Deidentified Data
- Conditioned formatted data

Clinical Site N
- Original Data
- Deidentified Data
- Conditioned formatted data

Data Used For AI Development

Clinical Site 1
- Data Labelling

Clinical Site M
- Data Labelling

Algorithm Training & Development
Using the Power of Ultrasound & AI to Transform the Physical Examination of Heart & Lungs

US

DA

ECG

AI – DEEP LEARNING
A Transformational Tool for Heart and Lungs Assessment
Thank you