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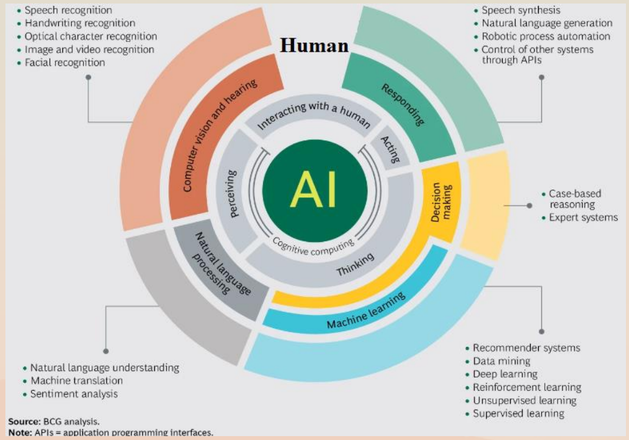
Updates on Artificial Intelligence and Nuclear Medicine Imaging

Overview of AI capabilities relative to humans:

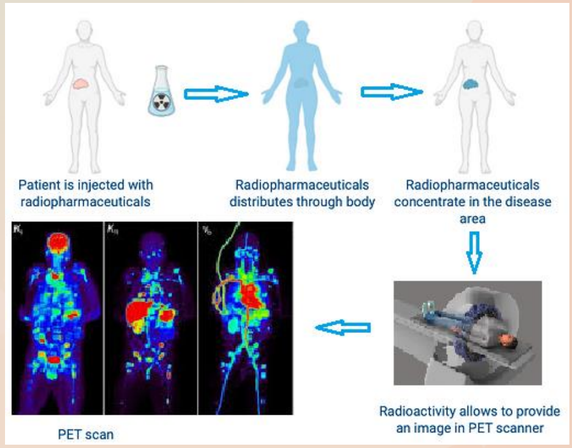


[Modified from www.bcg.com/publications/2017/telecommunications-technology-digital-tebit-2017-executive-report-time-double-down-ai-robotics]

Artificial Intelligence (AI) applications in nuclear medicine imaging have focused on the diagnosis, treatment monitoring, and correlation analyses with pathology.

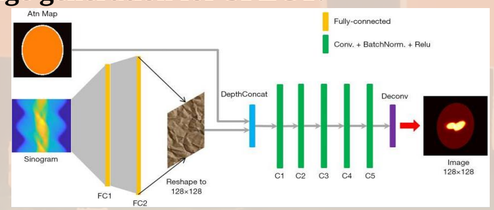
AI has been used for image generation to shorten the time of image acquisition, reduce the dose of injected tracer, and enhance image quality.

Current clinical applications of AI in image generation for single-photon emission computed tomography (SPECT) and positron emission tomography (PET), as illustrated in the next panel..



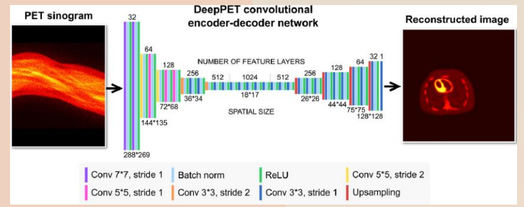
[Modified from deep-pharma.tech/ai-in-nm-q1-2023]

AI in image generation for SPECT:



Visvikis, *et. al.*, used AI network architecture to perform an end-to-end SPECT image reconstruction. Their artificial neural network (ANN) consisted of two fully connected layers followed by five convolutional layers. ANN was designed to accept SPECT projection data and attenuation-correction map at its input, and to output a 2-D quantitative activity image showing the distribution of the ^{123}I- Ioflupane in the brain. [For further details, please consult source: ncbi.nlm.nih.gov/pmc/articles/ PMC82486162/pdf/atm-09-09-820.pdf]

AI in image generation for PET:



Häggström, *et.al.*, developed a novel end-to-end PET image reconstruction technique, called DeepPET, based on a deep convolutional encoder–decoder network, which takes PET sinogram data as input and transforms the data into outputs of high quality, diagnostically useful PET images. [Source: sciencedirect.com/science/article/abs/pii/S1361841518305838]

Summary of the essential elements for a robust and reliable AI system in nuclear medicine.

(1) Performs with accuracy, reliability, and reproducibility.
(2) Prioritizes patient safety and harm prevention.
(3) Complies with all required cybersecurity standards, including assessment of data poisoning within the machine learning data set.
(4) Well-documented methodology (algorithm change protocol) to evaluate the robustness and safety of the updated AI system prior to its implementation (to prevent Crowdstrike-like event that could impact the health and safety of patients).