Informatics

Deep Learning in Medical Imaging – A Bit of Demystification

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Learning Objective: For practitioners in the field of medical imaging to gain basic understanding about the technique of deep learning (DL); to understand its basic premise, approach, and implementation.

Background: Artificial intelligence (AI) – specifically DL – has exploded in popularity in the past five years, demonstrating paradigm-shift levels of performance in various fields including medical imaging. It is likely to bring about significant changes to clinical practice as its adoption increases. Compared to traditional AI techniques, DL makes almost no assumptions about the specific means of solving a problem; using only stacked layers of simple equations trained on data to derive a solution. This flexibility largely explains why DL is generalizable to many problem domains.

Findings and/or Procedure Details: To utilize DL, practitioners have to (1) define their problem numerically, both for the input (e.g. image or lab result) and desired output (e.g. probability of disease outcome), and (2) collect large quantities of data for training and testing. The actual DL frameworks are of comparatively minor importance; the field has settled on a few design variants for each class of problems (e.g. "U-nets" for image segmentation). In DL, the data is what matters.

Conclusion: DL is an AI technique where computers are trained to solve a problem by iterating millions of times over a set of training examples. If a practitioner can define their problem's inputs and desired outputs numerically and collect large quantities of example data, then DL is relatively easy to implement and will likely give good results.