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Silver Tsunami

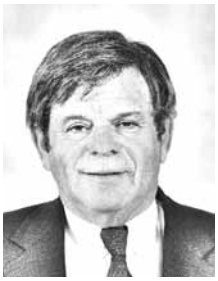

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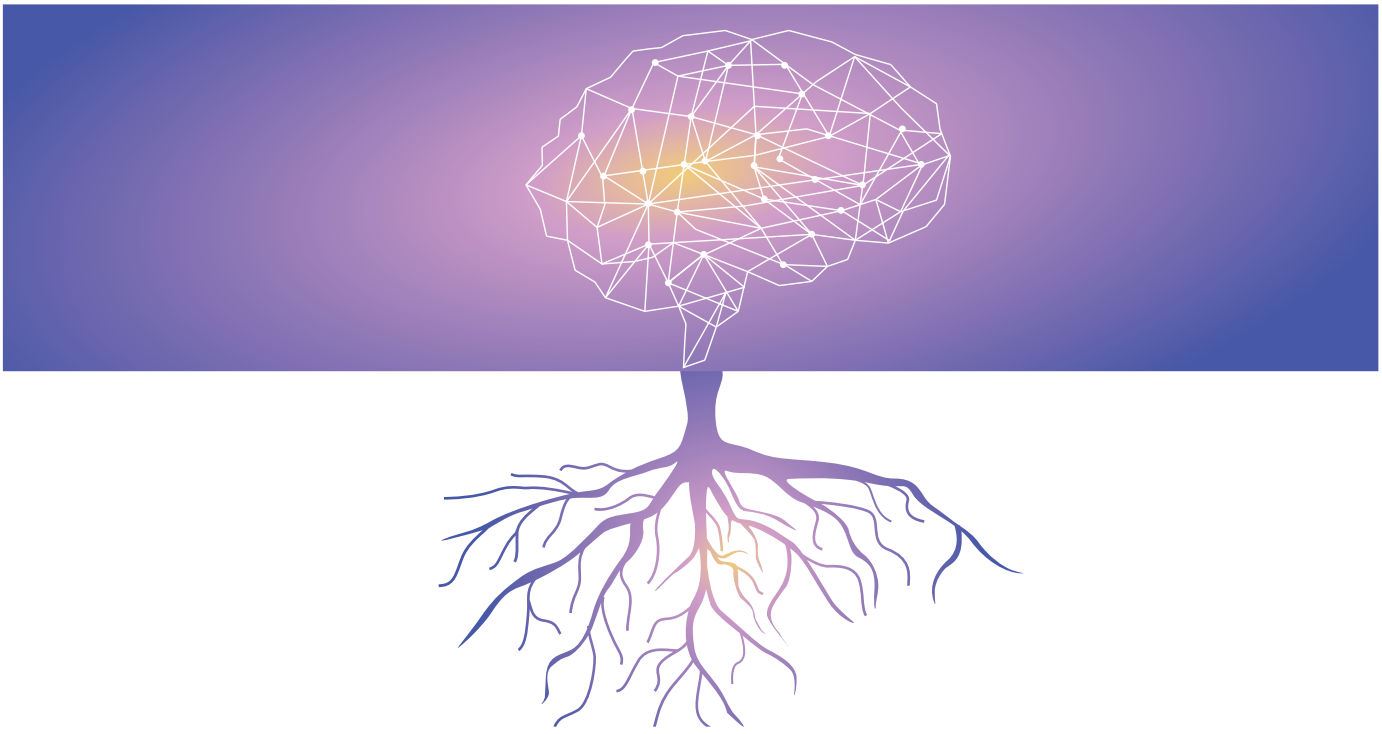
Image Information Delivery in the AI Era: Two Likely Scenarios

Summary: As the world enters further into the transformative power of technology, Stephen Baker questions how this information revolution, in particular, AI will affect the capabilities available to industry experts.



Many fields of knowledge, dependent on technology, can experience abrupt, massive growth as new techniques and novel forms of organisation come on stream and become incorporated within the standard canon. Radiology experienced this phenomenon in the 1980s in response to the nearly simultaneous introduction and deployment of cross-sectional imaging modalities, CT, US and MR, and advances in interventional procedures which together broadened the specialties' reach and deepened its insights into diagnosis and treatment. These coordinated boons to patients and to radiologists enlarged our volume of work but only marginally altered the way we transmitted our expertise to referrers. Those innovations were well accepted and, for the most part, were well accommodated within the established function of radiologists as primarily consultants to other physicians, not as direct communicators with patients, with the exception of course of mammography and angiography.

Now, we have entered into a second transformative practice paradigm, one both profound in the enhancement of capabilities and disruptive to the transmission of expertise. It will not only improve diagnostic capabilities but it will also alter the relationship of radiologist to referrers and even the very status of the radiologist in the care-giving enterprise. I refer of course to the imposition of Artificial Intelligence (AI) to imaging. The growth of machine learning applied to pattern recognition has been rapid, both in its comprehensiveness for particular conditions and for its widening application to most examinations under Radiology's purview. The attention now given to it is not merely a parochial one confined to physicians and their practices but rather it is also of interest to health administrators, policy analysts, and to the general public. The implications of its enlarging presence are societal and economic as well as medical. Not only have we established a radiology journal dedicated to AI but also in the U.S., for example, it has become a key component of the agenda addressing health care resource allocation.

Coming to grips with the implication of its widespread deployment is hard to measure and for some even to comprehend in this the incipient phase of what has been rightly labeled an information revolution. Early on with such a formidable change lurking, it is characteristic of those wedded to pre-existing models to deny with disdain something so radical. Others have looked upon it as a welcome addition to our customary functions, a tool to add to our diagnostic armamentarium, fully under the control of radiologists. But the disquieting evidence continues to accumulate that AI recognition of (1) the presence or absence of abnormality, (2) the patterns of disease and normalcy and (3) when findings are present with their extent, multiplicity and/or singularity exceed conventional capabilities of even the most perceptive radiologist. AI will likely prove to be more incisive for spatial discernment than those of mere human readers – a fact that at this stage of development seems obvious and insistent.

Now, of course, radiologists are not in jeopardy as providers of interventional procedures. And their expertise can be valuable as providers of decision support when needed, a function most often sought in ER and inpatient settings for patients with complex problems for which the sequencing of imaging examination plays a part in diagnosis and management. But, overwhelmingly, radiologists are "film" readers. Their interaction with referrers is standardised if not conventionally standoffish limited to test result opinion rendering transmitted unidirectionally and increasingly distant in place and, except for emergent requests, distant in time to varying degrees.

How soon will the AI revolution be completed? No one knows for sure but previous technological makeovers are often effectuated within ten or fifteen years. In the United States the 1830s was the decade of canal building yet, by 1840 these new such ventures were largely abandoned, displaced by the rapid expansion of railroads. The first talking picture came on screen in 1928. Gone With the Wind appeared in 1939 when silent films had become just a memory. Radio dramas - soap operas - were very popular during and just after World War II. But, they too, rapidly disappeared from that medium and by 1957 almost all were transferred to TV.

Hence, we should suspect that both the medical and the general public will demand AI-rendered diagnoses within a decade. Where does that leave the radiologist? Two scenarios come to mind – each akin to temporally parallel advances in another mode of delivery – the transfer and receipt of purchased packages.

> "THE GROWTH OF MACHINE LEARNING APPLIED TO PATTERN RECOGNITION HAS BEEN RAPID"

The first model corresponds to the semi-autonomous delivery system. Self-driving cars will be deployed to bring products from suppliers to consumers. But most likely the public, initially at least, will have persisting concerns about the safety of these conveyances when travelling on highways and byways. So, they will move along, at least at first, with a human inside them. A qualified rider will also be present to set things right if a wrong route is taken or danger appears. Analogously, an AI generated report will be inspected or otherwise overseen by a radiologist who will not read every study but will nonetheless put on the report his or her imprimatur to vouchsafe quality. But, most likely, as the AI generated interpretation is accepted as being standard, cost will be scrutinised and the compensation according to the radiologist as a QA monitor rather than an expert reader will be adjusted downward.

The second scenario for which the package delivery metaphor is also apt is one that will perhaps be more enduring. It could be labeled the drone delivery model. Here the AI interpretation will be sent to the referrers over an electronic "airway" without the radiologist's immediate oversight. A fly-alone drone will soon be the means by which purchases are sent to complete an order. The implications of this delivery mode are much more consequential for the radiologist than is the semi-autonomous vehicle delivery proposal. For with it, the radiologist can be effectively displaced becoming a supernumerary actor in the diagnostic encounter. And as such, a radiologist's claim to lasting hegemony over imaging will be challenged. Moreover, as a consequence, their proprietorship of imaging modalities will be questioned. With this mode of information transfer, the oncologist or the orthopedist may seek to make the CT and MR machines they rely on become part of their equipment resources with all that that allocation of such ownership transfer entails.

I regret having to elaborate to some small degree such a dystopian prospect for my fellow radiologists. Yet technological advances are not necessarily sympathetic to long standing advantages hallowed by custom and comfort. I hope these two scenarios will not come to pass but that does not mean they should be ignored in the face of accumulating evidence for their realisation. ■

KEY POINTS

- Industries dependent on technology are seeing abrupt change.
- Radiology has entered its second transformative phase.
- AI will have a profound effect on the expert's competence.
- AI has become a key when addressing health care resource allocation.
- AI will change how radiologists deal with patients and their status within the workplace.
- It's predicted that both medical and public will demand AI-rendered diagnoses within a decade.
- The radiologist could effectively become surplus to requirements.