plan that factors in imaging characteristics, patient comorbidities, patient age, and yes, surgeon ability. Informing these heuristics are clinical studies, guidelines, and the individual surgeon’s training and experience. If radiomics is to make a difference and encroach on current standards for decision-making, it will have to be simple to apply and clearly result in improved decisions or else face slow adoption.

References

Commentary: Fear not the rise of the machines

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Contemporary medicine and computers have become irreversibly intertwined. Every image, note, and order flows through a microprocessor. Many physicians hate their computers, and some fear that we will become slaves to technology or be replaced by it.1 We should harness the capabilities of machines to see what our eyes cannot so we can make the decisions that the machines cannot. Artificial intelligence has not yet reliably surpassed the ability of clinicians, but the day is coming.2

Yoshiyasu and colleagues3 in this issue of the Journal describe the use of radiomics to differentiate between less-invasive adenocarcinomas such as adenocarcinoma in situ or minimally invasive adenocarcinoma from more-invasive cancers with an acceptable degree of sensitivity and specificity. Increasing use of computed tomography screening and incidentally detected nodules have left thoracic surgeons with therapeutic dilemmas. In the case of partially solid nodules, pretherapy knowledge that a particular lesion is an adenocarcinoma in situ or minimally invasive adenocarcinoma allows for greater flexibility in treatment planning. Many of these nodules can be difficult to localize and may require complex anatomic resections when they might be safely followed or treated nonoperatively. The authors provide a primer on radiomics and describe the process of quantifying several radiomic variables that cannot be discerned by the human eye but efficiently performed by a computer, such as variance, kurtosis, skewness, and entropy.

Yoshiyasu and colleagues created a model that combined 2 traditional “eyeball” variables (percent solid and tumor volume) with 2 “advanced” variables (entropy and skewness). Not surprisingly, the most important variable in the model is percent solid. This model was highly accurate at predicting less-invasive cancers.3 This technique appears easily scalable and applicable to an increasing number of patients with ground-glass opacities or semi-solid nodules in whom the decision to offer sublobar or nonanatomic resection may subject the patient to possible undertreatment, which would then force the patient and surgeon to consider reoperation if greater than minimally invasive adenocarcinoma is
ultimately diagnosed at final pathology. Conversely, some patients may be saved from overtreatment with lobectomy when sublobar resection or nonoperative therapy such as radiation would be adequate.

Computers generate computed tomography images from acquired data; perhaps we should use computers to convert that data into meaningful information. The process can be automated and is fast, with a mean time of 30 seconds in the present study. The optimal algorithms and proper variables remain to be determined in larger prospective trials. Radiomics is also evolving into radiogenomics, where radiomic data can be used to predict mutations in lung cancers and the response to chemotherapy. Many clinicians use widely available algorithms, such as the Mayo Clinic model, which incorporate clinical and basic radiographic data to predict the likelihood of malignancy. Ultimately, clinical information could be merged with radiomics to help clarify or make the diagnosis, potentially sparing the patient additional diagnostic procedures and over- or undertreatment. Thus the patient and the surgeon would be allowed to focus on decision making, and potentially pull the doctor away from the machine and toward the patient.

References