

AbstractID: 4572 Title: A search model for medical image interpretations

Search involves locating lesions in images under conditions of uncertainty regarding the number and locations of lesions that may be present. A mathematical model of search is presented that applies to situations, as in the free-response paradigm, where on each image the number of normal regions that could be mistaken for lesions is unknown and the number of observer generated localizations of suspected regions (marks) is unpredictable. The search model is based on a two-stage descriptive model proposed in the literature according to which at the first stage the observer uses mainly peripheral vision to identify likely lesion candidates, and at the second stage the observer decides whether or not to report the candidates. The mathematical search model regards the unpredictable numbers of lesion and non-lesion localizations as random variables and models them via appropriate statistical distributions. The model has three parameters quantifying the perceived lesion signal-to-noise ratio, the observer's expertise at rejecting non-lesion locations and the observer's expertise at finding lesions. A figure-of-merit quantifying the observer's search performance is described, as well as ROC and FROC curves predicted by the search model. Finally, we describe a preliminary method for estimating the parameters of the search model from free-response data.