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Research question:

Segmentation and operationalization of dental x ray image artifact induced by Phosphor Storage Plates (PSP) damage using machine learning

Background and objective:

PSP (Phosphor Storage Plates) are commonly used sensors for digital dental x rays. However, after a prolonged period of use, plates begin to acquire artifacts such as bends and bite marks which can show up on the final image and interfere with diagnosis. In clinics, PSP plates are often reused for 50-400 times before they are discarded and replaced with new ones. Yet the decision of whether to discard a plate or not is made rather arbitrarily. Thus, our objective is to establish a system of classifying artifacts based on the predicted ability of them to impede diagnosis to ensure that PSP plates are only thrown away when necessary and also to avoid missed diagnosis.

Hypothesis and rationale:

Ultimately, the approach is to use supervised deep learning algorithms such as convolutional neural network (CNN) to learn the relationship between the artifacts and the label provided by clinicians of whether they affect diagnosis. However, the labels are not available for the moment, and with the amount of samples that we have, it might not be enough for a data-hungry algorithm like CNN. Thus, traditional machine learning algorithms is also an option that we can not dismiss. Our hypothesis is that the effect of the artifact on diagnosis is in some relationship with the location, intensity, shape and size of the artifact itself, and if we can segment the artifacts and operationalize the above-mentioned variables to give a quantitative index for each of them and a combined index for the overall artifact, we can later on use simpler algorithms which require less data than deep learning to learn that relationship and make predictions on real world samples. In addition, our operationalization of the artifacts, if robust, could also be generalized for uses other than the purpose of our project.