Segmentation, characterization and superimposition of PSP damage-induced dental X-ray artifacts

* Introduction
  + Background
    - Phosphor Storage Plates (PSPs) and their use in dental imaging; comparison to complementary metal oxide semiconductor (CMOS).
    - Problem of producing image artifacts that comes with using PSPs.
    - Concerns and evidence that PSP artifacts could impede diagnosis.
    - Previous attempts of classifying and quantifying artifacts and their shortcomings.
  + Research question
    - Research question: Can we segment, characterize artifacts and superimpose them onto clean teeth images for future studies?
    - Hypothesis: We can segment, characterize and superimpose the artifacts using an algorithmic approach.
* Objectives and methods
  + Objectives
    - Segment the artifacts from the image;
    - Quantify and characterize the artifacts;
    - Cluster the segmented artifacts;
    - Superimpose artifact images onto clean teeth images to mimic real dental images taken with damaged PSPs.
  + Methods
    - Preprocessing
      * Contrast limited histogram equalization
    - Superimposition
      * Linear combination of two images
      * Different weights of linear combination for different pixel thresholds
      * An exponential weighting function
    - Validating superimposition
      * Scale-invariant feature transform (SIFT): feature matching
      * Structure similarity index (SSIM)
    - Segmentation
      * Canny edge detector
      * Density based spatial clustering algorithm with noise (DBSCAN)