Many artists are known to have reused their canvases, painting new works on top of partially developed or even completed previous paintings. For example, a recent study at the Van Gogh Museum in Amsterdam found that of 130 Van Gogh paintings, 20 (roughly 15%) contained some sort of hidden painting under the surface. With new X-ray fluorescence imaging technology, it is now possible to determine the amount of various chemical elements (comprising both surface and hidden painting pigments) in each location across the surface of these canvases. This new technique provides a rice source of data to use in reconstructing an estimate of what the lost painting under the surface might have looked like.

In this talk, we will describe new image processing methods that we have been developing for virtually reconstructing images of these hidden paintings from X-ray fluorescence data. In particular, our methods will address four stages of virtual reconstruction: (1) repairing acquisition artifacts in the dataset, (2) removal of features in the images that result from features of the surface painting rather than those of the underpainting, (3) identification and inpainting of areas of information loss, and (4) estimation of colors from pigment concentrations. We will describe methods we have developed to address each of these stages and show results on lost paintings by the artists Vincent van Gogh and Philipp Otto Runge.