TITLE: Healing X-ray scattering images.

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ABSTRACT: X-ray scattering is a powerful technique for measuring the structure of samples at the molecular and nano-scale. Scattering consists of shining a bright x-ray beam (e.g. from a synchrotron), and measuring the scattered rays on a two-dimensional detector. X-ray scattering images contain numerous gaps and defects arising from detector limitations and experimental configuration. We present a method to 'heal' X-ray scattering images, filling gaps in the data and removing defects. Unlike generic inpainting methods, this method is closely tuned to the known physics of scattering, and thus heals in a physically meaningful manner. We exploit statistical tests and symmetry analysis to identify the structure of an image; we then copy, average and interpolate measured data into gaps in a way that respects the identified structure and symmetry. Importantly, the underlying analysis methods provide useful characterization of structures present in the image, including the identification of diffuse versus sharp features, anisotropy and symmetry. Our method succeeds in filling gaps and healing defects in experimental images, including extending data beyond the original detector borders.

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