Two algorithms for adaptive approximation of bivariate functions by piecewise linear polynomials on triangulations

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We present two algorithms generating adaptive triangulations for the approximation of bivariate functions, in particular images. The first is top-bottom, starting from a triangulation of a given large set of sample points, and terminating with a coarse set of triangulated 'significant' points. The approximation employed is continuous piecewise linear polynomials over the triangulations. The second algorithm is bottom-top, starting from a coarse triangulation of the domain of definition of the function, and refining it by splitting at each step a triangle where the error is maximal. The approximation employed is discontinuous piecewise linear polynomials over the triangulations. While both algorithms are greedy, with each step chosen so as to minimize the L^2-norm, and both allow for error control, only the second generates a sequence of nested triangulations and refined approximants. This last property is the key for efficient encoding of the final approximation.

The first algorithm was developed together with Laurent Demaret, Mike Floater and Armin Iske. The second algorithm is a work in progress in collaboration with Albert Cohen and Frederic Hecht.