Sampling Theorem in Terms of the Bandwidth and Sampling Interval

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An approach has been developed for interpolating non-uniformly sampled data, with applications in signal and image reconstruction. This innovation generalizes the Whittaker-Shannon sampling theorem by emphasizing two assumptions explicitly (definition of a band-limited function and construction by periodic extension). The Whittaker-Shannon sampling theorem is thus expressed in terms of two fundamental length scales that are derived from these assumptions. The result is more general than what is usually reported, and contains the Whittaker-Shannon form as a special case corresponding to Nyquist-sampled data. The approach also shows that the preferred basis set for interpolation is found by varying the frequency component of the basis functions in an optimal way.