

In many applications, the observations can be represented as a signal defined over the vertices of a graph. The analysis of such signals requires the extension of standard signal processing tools. In this paper, first, we provide a class of graph signals that are maximally concentrated on the graph domain and on its dual. Then, building on this framework, we derive an uncertainty principle for graph signals and illustrate the conditions for the recovery of band-limited signals from a subset of samples. We show an interesting link between uncertainty principle and sampling and propose alternative signal recovery algorithms, including a generalization to frame-based reconstruction methods. After showing that the performance of signal recovery algorithms is significantly affected by the location of samples, we suggest and compare a few alternative sampling strategies. Finally, we provide the conditions for perfect recovery of a useful signal corrupted by sparse noise, showing that this problem is also intrinsically related to vertex-frequency localization properties.