A Scalable M-Channel Critically Sampled Filer Bank for Graph Signals
Reviewer Comments

This paper adds to the literature of graph filter banks where differently from some of the state-of-the-art methods the synthesis filters are replaced with interpolation operators to alleviate the scalability of computation. The paper main contribution is in putting together several methods (separately known) including the Chebyshev polynomial approximation, spectral density estimation, and random sampling to propose a graph filter bank that scales favorably with the number of nodes.

The paper is well structured and the results are sound. From a practical viewpoint, I find the contribution relevant. However, I believe the following points must be addressed before recommending publication.

1. A real application and a comparison with other methods are missing. Since the paper has more practical contribution, I would prefer to see a direct applicability case. In the introduction section, the authors mention that transforms and filter banks are useful among other to compress, remove noise, or fill missing information in graph-based data. Would it be possible to add a case and compare the performance with other methods including simple graph filters like the FIR and ARMA (e.g., [R1])? Since graph filters can also be used for the aforementioned applications, it is worth comparing the performance of the proposed method with similar computational complexity.
2. Consider explaining what is a critically sampled filterbank. This may not be known to all readers.
3. Consider mentioning esplicitly in the introduction section the knowledge gap and why is that important. Also, I recommend to state in more detail the differences with [27] and also w.r.t. [R2, R3]. The latter will enhance even more the benefits of the current work with respect to other alternatives.
5. A figure describing the pipeline of the several methods used in Section IV would help to get the bigger picture. I have the feeling that some readers can get lost in the details of the particular subsections/paragraphs. The latter can be easily added to the wordy description in Sec. IV-F.
6. Fig.11 bottom line: Can you provide more insights on the performance difference between the lowpass and bandpass case. Also, it seems that the signal adapted M-CSFB does a better job only in a high number of samples regime. Why is this?
7. The paper and especially the numerical section would benefit a lot by providing more insights about the tradeoff between the filter order (K), the number of channels (M), and the number of samples.
8. I am also wondering if the number of samples would decrease if another type of filter is used (e.g., [R1]). Often these filters lead to a lower order in approximating a sharp response, which might be exploited for further reducing the number of samples. Can the authors provide more comparisons in this regard?

Writing:

i. Lemma 1: S should be in calligraphic;

ii. Please check the use of commas. Often are missing;

iii. \mathbf{u}_{\Tau_i} is not defined in Lemma 1;

iv. The terminology “analysis coefficients” may be misinterpreted with the coefficients of the FIR filters used in the analysis part;

v. Sec. IV-E line 42: U_{V_m, R_M} should be in bold;

vi. The font size in the appendix is too small.

References:

[R1]: Liu et al, Filter design for autoregressive moving average graph filter, IEEE TSIPN, 2018.

[R2]: Tanaka, M-Channel oversampled graph filter banks, IEEE TSP 2014.

[R3]: Tay, Ortega, Design of near-orthogonal graph filter banks, IEEE SPL 2014.