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Reference Letter for Dr. Man Shun Ang

To Whom It May Concern

I have the pleasure to write this letter to recommend Dr. Ang to his application to UW-Fields Postdoc fellowship.

In general, Man Shun Ang works on the area of matrix and tensor factorization, with a focus over the empirical, methodological and theoretical aspects. He is specialized on a specific class of model called Non-negative Matrix Factorization (NMF). His research excellence can be demonstrated by his several original works on solidating and extending the knowledge in matrix-tensor factorizations. The empirical research works of Man Shun Ang, namely the papers ``Algorithms and Comparisons of Non-negative Matrix Factorization with Volume Regularization for Hyperspectral Unmixing", ``Minimum-Volume Rank-Deficient Nonnegative Matrix Factorizations" and ``Volume regularized Non-negative Matrix Factorizations" have justified the uses of volume regularizers in NMF. These works give general guidelines on choosing which volume regularizer to use in solving NMF problems, and the works also give suggestions on how to tune the regularization parameters. Secondary, Man Shun Ang has also demonstrated and discussed the effectiveness of using NMF with volume regularizer in the rank-deficient case, which is the first paper in the field addressing such phenomenon. To be specific, it is showed in the paper ``Blind Audio Source Separation with Minimum-Volume Beta-Divergence NMF'' that the volume regularizer will automatically set the overestimated components to zero in the factorization. All these bring impacts to the application fields of NMF such as hyperspectral imaging and audio source separation, as Man Shun Ang's works partially resolve some open problems in these fields.

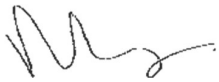
For the methodological research of Man Shun Ang, for example, the papers ``Accelerating Block Coordinate Descent for Nonnegative Tensor Factorization", ``Accelerating Nonnegative Matrix Factorization Algorithms using Extrapolation" and ``Extrapolated Alternating Algorithms for Approximate Canonical Polyadic Decomposition" mainly consist of the development of a series of methods on solving matrix and tensor factorization problems. He proposed a framework called Heuristic Extrapolation with Restarts (HER), that is documented to be able to significantly accelerate various algorithms on solving different matrix and tensor factorization problems, where the significance is demonstrated by the amount of improvement in the convergence speed, the generality of the HER method, and the low additional computational overhead of the HER. Despite lacking a solid theoretical support of the proposed method, the significance of HER proposed by Man Shun Ang is already huge as the HER method is documented several times in different application scenarios that outperforms several highly cited approaches in the literature, such as the block active set methods, alternating optimization ADMM and the accelerated block alternating proximal gradient methods. His methodological contribution would become even more impactful if he is managed to derive a theoretical convergence analysis to support his HER algorithm.

For the theoretical research of Man Shun Ang, namely the paper ``Blind Audio Source Separation with Minimum-Volume Beta-Divergence NMF", it addresses an unknown phenomenon on why NMF can often extract the correct structure in the data. This work gives a theoretical foundation of NMF in explaining why NMF model is provably correct in data science applications.

Apart from the research publications, the leadership in research of Man Shun Ang can be demonstrated by giving oral presentations in a number of leading-edge international conferences related to his research, namely the SIAM Conference on Applied Linear Algebra (SIAM-ALA18), the 23rd International Symposium on Mathematical Programming (ISMP2018), and the Sixth International Conference on Continuous Optimization (ICCOPT2019). He is also invited by the referee as the speaker in the ``Workshop on Matrix and Tensor Computations" in Department of Mathematics, University of Hong Kong, on January 22, 2020.

I highly recommend him to be a member of your group. Please feel free to contact me if you wish to know more about Dr. Ang.

Yours Sincerely,



Michael Ng