



北京理工大学

数学与统计学院学术报告

On the Epistemology of Gibbs Ringing Reduction

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时 间: 2025年10月27日10:00

地 点: 中关村校区信息科学实验楼501

摘 要: Gibbs ringing is an oscillating artifact that appears around sharp transitions in a signal reconstructed from Fourier data. For example, it appears at tissue boundaries in magnetic resonance imaging where it may mislead clinicians or algorithms. There are many ringing reduction algorithms proposed in the literature. How do we make a systematic and quantitative comparison of ringing suppression algorithms? This includes our testing procedure, test signals, metrics, baselines, ground truths, datasets, and other factors. For example, metrics are investigated in terms of parameter selection for filtered Fourier reconstruction, which allows us to interrogate the quality of evidence for algorithms that are compared with sometimes poorly chosen filters. Test signals are investigated in terms of the quality of evidence for Gegenbauer reconstruction. The discussion on metrics led us to consider questions of signal sparsity, which then led us to cast reconstruction of a discontinuous signal from Fourier data as a compressive sensing problem, a novel approach. Finally, metrics also led us to a discussion of cost functions in machine learning approaches to ringing suppression, along with the nature of the data used to train those algorithms. Ultimately, this is a story of poor epistemology in an image processing problem.

个人简介: John J. Healy was born in Co. Dublin, Ireland in 1983. He was awarded the B.E. and Ph.D. degrees in Electronic Engineering from University College Dublin in 2005 and 2010. He has worked as a postdoctoral fellow in Physics in UNAM, Mexico, and in Computer Science and Electronic Engineering in Maynooth University. In 2012, he was awarded the NUI Postdoctoral Fellowship in the Sciences. He has been a Lecturer in Electrical, Electronic and Communications Engineering in UCD since 2015. He is a member of the IEEE, and a Senior Member of Optica and of SPIE.