Public Abstract
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Title: Directional Time-Frequency Analysis with Applications

We develop a new form of time-frequency analysis which is sensitive to direction. This is done by combining the properties of the Radon transform with standard time-frequency analysis. This analysis breaks down a signal into different time-frequency-direction "pieces." We are able to reconstruct the signal from these pieces and are also able to analyze the corresponding coefficients to determine how much of a certain frequency there is at a certain part of the signal along a certain direction. Along with this comes the standard properties from time-frequency analysis, including a Parseval identity, an orthogonality property, and a frame-type relationship.

This analysis lends itself to many applications including image processing techniques like image compression, image processing, and denoising. Because we apply the Radon transform for directional sensitivity, which is already used in many different imaging modalities, we may also achieve these applications in medical imaging.