UNIVERSITY OF MINNESOTA
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Sliding Windowed Infinite Fourier Transform (SWIFT)

Real-Time Digital Signal Analysis

The Sliding Windowed Infinite Fourier Transform (SWIFT) algorithm analyzes and extracts frequency amplitude/phase information from digital signals in real time. This spectral analysis technique analyzes any real-time digital signal, from neural signals to accelerometer data to radio waves. The algorithm uses an infinite length causal exponential function as its window, which gives more weight to more recent samples, allowing SWIFT to be more sensitive to transient changes. This technology is guaranteed stable and has lower computational cost and memory requirements and improved frequency resolution and sampling as compared to other real time techniques. In addition, a modified version (αSWIFT) further reduces spectral leakage.

Overcomes Sliding DFT Limitations

The discrete Fourier transform (DFT) is the standard tool for spectral analysis in digital signal processing, typically computed using the fast Fourier transform (FFT). However, for real-time applications that require recalculating the DFT at each sample or only over a subset of the N center frequencies of the DFT, the FFT is far from optimal. Sliding DFT (SDFT) computes individual DFT bins recursively but is only marginally stable and requires storing N previous inputs. Furthermore, its rectangular window causes spectral leakage. The SWIFT technology overcomes these limitations and is faster, requires less memory, produces cleaner data, can select any frequency and is more stable than currently used algorithms.

BENEFITS AND FEATURES:

- Analyzes and extracts frequency amplitude/phase information from digital signals in real time
- More sensitive to transient changes by using an infinite length causal exponential function as its window
- Guaranteed stable
- Low computational cost and memory requirements
- Good frequency resolution and sampling
- Reduces spectral leakage

APPLICATIONS:

- Digital signal processing
- Extracting frequency phase/amplitude information from any digital signal
- Deep Brain Stimulation
- Cochlear implants
- Brain computer interface (BCI)
- Speech to text applications
- Cellular devices
- Implantable neural, cardiac, or other devices
- Wearable technology

Phase of Development - Product available

Researchers

Technology ID
20170293

Category
Engineering & Physical Sciences/Instrumentation, Sensors & Controls
Engineering & Physical Sciences/Robotics
Life Sciences/Diagnostics & Imaging
Life Sciences/Human Health
Life Sciences/Medical Devices
Life Sciences/Neuroscience
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Matthew Johnson, PhD
Associate Professor, Biomedical Engineering, College of Science and Engineering
External Link (bme.umn.edu)
Tay Netoff, PhD
Assistant Professor, Biomedical Engineering, College of Science and Engineering
External Link (www.neuroscience.umn.edu)
Logan L. Grado
Graduate Student, Biomedical Engineering

Publications

The Sliding Windowed Infinite Fourier Transform
IEEE Signal Processing Magazine, Volume 34, Issue 5

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