Anamorphic Spectrum Transform And Its Application To Time-Bandwidth Compression

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OTHER INFORMATION

KEYWORDS

anamorphic spectrum transformation, time-bandwidth compression, data compression, anamorphic transform, big data, data storage, analog signal, digital signal, analog to digital conversion

CATEGORIZED AS

- Computer
- Software

RELATED CASES

2013-972-0

SUMMARY

UCLA researchers in the Department of Electrical and Computer Engineering have developed an Anamorphic Spectrum Transformation (AST) scheme for compressing the time-bandwidth product of analog signals, making it easier to digitize wideband signals and to reduce the volume of the digital data generated.

BACKGROUND

Efficient compression of analog and digital data helps the processing, communication and storage of these forms of data. Compression of temporal signals, such as communication signals or those generated by sensors, involves sampling at a sufficient rate so as to obtain desired signal information and then being able to communicate or store that data efficiently. One existing mechanism for reaching a sufficient sampling rate involves time-stretching to trade off intensity-bandwidth and temporal-duration, thus allowing sampling to be performed at a lower rate while proportionally increasing the temporal duration. Time-stretching performed in the analog domain prior to sampling reduces signal bandwidth, but does not reduce the time-bandwidth product because the signal is temporally stretched in time, whereby storage requirements remain constant. Current data compression techniques operate on digital data only. The analog data from high speed sensors and instruments is often too fast to be digitized in real time. Therefore, a need exists for an enhanced data compression method which reduces modulation intensity bandwidth without a proportional increase in temporal duration.

INNOVATION

Researchers at UCLA have developed a novel Anamorphic Spectrum Transformation (AST) scheme for compressing temporal data. This AST scheme achieves time-bandwidth compression by performing feature selective sampling, wherein fast features of the signal are sampled at a higher rate than slow features containing temporal redundancy. The AST is a physics-based signal transformation that enables a digitizer to capture random signals that would otherwise be beyond its bandwidth, and at the same time compress the digital data volume. Overall, AST makes it possible to capture high-throughput signals in real-time and to alleviate the storage and transmission bottlenecks associated with the resulting big data.

APPLICATIONS

The described AST scheme can be used for applications involving analog signals, optical signals, electronic and microwave signals, digital data, “big data” systems, spectroscopy, genome sequencing, analog to digital conversion, temporal imaging, etc.

ADVANTAGES

- Compresses the modulation bandwidth of the input analog signal while minimizing its duration

STATE OF DEVELOPMENT

- Completed proof of concept experiments

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,479,192	10/25/2016	2013-972

RELATED MATERIALS

- Asghari, M.H. and Jalali, B., 2013. Anamorphic transformation and its application to time–bandwidth compression. Applied optics, 52(27), pp.6735-6743.
- Jalali, B. and Asghari, M.H., 2014. The anamorphic stretch transform: Putting the squeeze on “big data”. Optics and Photonics News, 25(2), pp.24-31.
- Asghari, M.H. and Jalali, B., 2014. Discrete anamorphic transform for image compression. IEEE Signal Processing Letters, 21(7), pp.829-833.
- Asghari, M.H. and Jalali, B., 2014. Experimental demonstration of optical real-time data compression. Applied Physics Letters, 104(11), p.111101.
- Jalali, B., Chan, J. and Asghari, M.H., 2014. Time–bandwidth engineering. Optica, 1(1), pp.23-31.

▶ Asghari, M.H. and Jalali, B., 2013, October. Demonstration of analog time-bandwidth compression using anamorphic stretch transform. In Frontiers in Optics (pp. FW6A-2). Optical Society of America.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Apparatus And Method For Optically Amplified Multi-Dimensional Spectrally Encoded Imaging
- Apparatus And Method For Multiple-Pulse Impulsive Stimulated Raman Spectroscopy
- Ultrafast Differential Interference Contrast Microscopy
- Global Training Of Neural Networks For Phenomic Classification
- A Single-Shot Network Analysis Method For The Characterization Of Opto-Electronic And Electrical Devices And Systems
- Apparatus and Signal Processing Technique for Real-Time Label-Free High-Throughput Cell Screening

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