TECHNOLOGY

Instantaneous Frequency Estimation and Localization for Electric Network Frequency (ENF) Signals

OVERVIEW

Background

Forensic analysis based on Electric Network Frequency (ENF) fluctuations is an emerging technology to authenticate multimedia recordings by extracting ENF signatures, and comparing them with ground truth electrical power frequencies for corresponding times of day. For example, audio recordings made near power lines, and video of objects illuminated by incandescent and fluorescent bulbs contain extractable ENF signals which differ from location to location. Current guidelines for frequency estimation use non-parametric approaches which have limited temporal frequency resolution due time-frequency resolution capability, and available computational power. For robust high-resolution matching, it is important to estimate instantaneous frequency using as few samples as possible. Furthermore, ENF frequencies of at a nominal resonance of 60Hz are typically difficult to capture with standard voice recorders, so there exists a need for finding and identifying usable ENF signals at alternative harmonics. The challenge is determining which harmonics are best for a signal of interest, and which harmonics can be combined in order to maximize the extracted signal and minimize noise.

Innovative Technology

Researchers at the University of Maryland have developed a method to measure Electrical Network Frequency (ENF) signals from multimedia recordings. The technique improves upon the researchers' earlier work of ENF signal analysis by obtaining a more robust estimate of the ENF signal. Furthermore, the location of ENF recordings can be determined by extracting a location specific signature signal (room lighting or power line audio) from the ENF signals to compare to known power signatures for various cities and towns.

APPLICATIONS

· Multimedia forensic science
· Recording/event localization, location stamping
· Recorded event time and date stamping

ADVANTAGES

· Wider range of useful recording devices & frequencies
· Improved signal-to-noise ratio (SNR) of extracted ENF signal
· Reduced computational requirements

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Additional Information

INSTITUTION

University of Maryland, College Park

PATENT STATUS

Patent(s) pending

LICENSE STATUS

Available for exclusive license

CATEGORIES

- Information Technology

EXTERNAL RESOURCES

- US Patent 9,363,467

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