Noise

1-Photonic chip-based low-noise microwave oscillator

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Abstract

Numerous modern technologies are reliant on the low-phase noise and exquisite timing stability of microwave signals. Substantial progress has been made in the field of microwave photonics, whereby low-noise microwave signals are generated by the down-conversion of ultrastable optical references using a frequency comb1-3. Such systems, however, are constructed with bulk or fibre optics and are difficult to further reduce in size and power consumption. In this work we address this challenge by leveraging advances in integrated photonics to demonstrate low-noise microwave generation via two-point optical frequency division4,5. Narrow-linewidth self-injection-locked integrated lasers6,7 are stabilized to a miniature Fabry-Perot cavity8, and the frequency gap between the lasers is divided with an efficient dark soliton frequency comb9. The stabilized output of the microcomb is photodetected to produce a microwave signal at 20 GHz with phase noise of -96 dBc Hz-1 at 100 Hz offset frequency that decreases to -135 dBc Hz-1 at 10 kHz offset-values that are unprecedented for an integrated photonic system. All photonic components can be heterogeneously integrated on a single chip, providing a significant advance for the application of photonics to high-precision navigation, communication and timing systems. We leverage advances in integrated photonics to generate low-noise microwaves with an optical frequency division architecture that can be low power and chip integrated.

Keywords

Keywords Plus

RESIDUAL PHASE NOISEFREQUENCY COMBLASERGENERATIONCAVITYSTABILIZATIONMICROCOMBSCONVERSION

Noise

2-Pixel-Level Noise Mining for Weakly Supervised Salient Object Detection

By Liu, KD (Liu, Kendong) [1] ; Feng, MT (Feng, Mingtao) [1] , [2] ; Zhao, W (Zhao, Wei) [1] ; Sun, JT (Sun, Jingtao) [3] ; Dong, WS (Dong, Weisheng) [1] ; Wang, YN (Wang, Yaonan) [3] ; Mian, A (Mian, Ajmal) [4] (provided by Clarivate) **Source IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS Volume 36 Issue 10 Page 18815-18829 DOI 10.1109/TNNLS.2025.3575255 Published OCT 2025 Early Access JUN 2025 Indexed 2025-06-12 Document Type Article**

Abstract

Training a deep model for visual saliency detection requires the collection and labor-intensive annotation of overwhelmingly large data. We propose to learn saliency detection in a weakly supervised manner from single noisy label, which is easy to obtain from unsupervised handcrafted feature-based methods. However, deep networks tend to overfit such noises leading to a dramatic drop in accuracy. Given our goal, we address a natural question: can we identify outliers during network prediction and rectify the label noises? To this end, we propose a pixel-level noise mining framework for robust salient object detection (SOD) by exploiting its own knowledge, and without the need for external models. Specifically, during the early training stage, we progressively identify the outliers from a novel perspective during saliency detection, before the network overfits to the noisy labels, and generate a selection matrix in each iteration. Next, we adaptively rectify the label noises under the guidance of the selection matrix for better supervision in the later training stage. Extensive experiments on multiple benchmark datasets demonstrate the superiority of our method showing its ability to learn saliency detection comparable to state-of-the-art fully supervised methods. Furthermore, our approach outperforms existing weakly supervised methods utilizing single noisy label and surpasses the half of existing weakly supervised methods employing multiple noisy labels. Our approach, which trains with multiple noisy labels, outperforms all other methods employing multiple noisy labels across four major datasets. Furthermore, we also evaluate the generalization ability of our method on the multiclass semantic segmentation (SS) task. Our code is available at https://github.com/kendongdong/NoiseMining

Keywords
Author Keywords
Noise correctionpixel-level noisy labelssaliency detectionweak supervision

Keywords Plus
MODEL

3- RTSMFFDE-HKRR: A fault diagnosis method for train bearing in noise environment

By He, DQ (He, Deqiang) [1] ; Zhang, ZH (Zhang, Zhihao) [1] ; Jin, ZZ (Jin, Zhenzhen) [1] ; Zhang, F (Zhang, Fan) [2] ; Yi, C (Yi, Cai) [3] ; Liao, SX (Liao, Shuixian) [1] (provided by Clarivate) **Source MEASUREMENT Volume 239 DOI 10.1016/j.measurement.2024.115417 Article Number 115417 Published JAN 19 2025 Early Access AUG 2024 Indexed 2024-08-16 Document Type Article**

Abstract

The bearings have been exposed to a noisy environment for an extended period, making it challenging to identify fault characteristics accurately and resulting in low accuracy. In this study, we proposed a technique for diagnosing train-bearing faults in noisy environments using refined time-shift multiscale fractional order fuzzy dispersion entropy and hybrid kernel ridge regression (RTSMFFDE-HKRR) to enhance the precision of fault detection. Firstly, RTSMFFDE is proposed based on multiscale fuzzy dispersion entropy by combining the theories of refinement, time-shifting, and fractional order. Revising the refinement process helps to stabilize the entropy value when dealing with a large scale factor. Implementing time-shifting techniques can help preserve the original signal features more effectively. The theory of fractional order strengthens the noise-resistant performance of the algorithm, and the proposed RTSMFFDE has a superior feature extraction capability. Subsequently, a hybrid kernel function is formulated through the combination of the radial basis kernel function (RBF) and the linear kernel function, aiming to improve the nonlinear mapping ability and anti-noise ability of ridge regression classification algorithm. Finally, two sets of experimental cases were used to verify the proposed RTSMFFDE-HKRR. The results show that the fault feature information extracted by RTSMFFDE in noisy environment is more comprehensive, and the classification effect of HKRR is more significant. In the fault diagnosis of two bearing simulation test beds, the accuracy rate of RTSMFFDE-HKRR is up to 100%. In the noisy environment, the accuracy rate is 98.84% and 97.32%, which is much higher than other diagnostic models. RTSMFFDE-HKRR is suitable for train bearing fault diagnosis in noisy environment.

Keywords
Author Keywords
Noisy environmentFault diagnosisFuzzy dispersion entropyFeature extractionHybrid kernel ridge regression

Keywords Plus
FUZZY DISPERSION ENTROPY

Noise

4-A robust filter and smoother-based expectation-maximization algorithm for bilinear systems with heavy-tailed noise

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By Wang, WJ (Wang, Wenjie) [1] ; Liu, SY (Liu, Siyu) [1] , [2] , [3] ; Jiang, YH (Jiang, Yonghua) [1] , [2] ; Sun, JF (Sun, Jianfeng) [1] ; Xu, WX (Xu, Wanxiu) [1] , [2] ; Chen, XH (Chen, Xiaohao) [1] ; Dong, ZL (Dong, Zhilin) [1] ; Jiao, WD (Jiao, Weidong) [1] , [2] (provided by Clarivate) **Source MECHANICAL SYSTEMS AND SIGNAL PROCESSING Volume 236 DOI 10.1016/j.ymssp.2025.112912 Article Number 112912 Published AUG 1 2025 Indexed 2025-07-05 Document Type Article**

Abstract

This paper focuses on a specific type of nonlinear systems-bilinear systems and introduces a robust filter and smoother-based expectation-maximization (RFS-EM) algorithm that enables joint estimation of states and parameters in the presence of heavy-tailed noise. Specifically, to mitigate the impact of heavy-tailed noise, this study explores a combination method of robust filter and smoother based on Student's t distribution, integrating it into an expectation-maximization framework. In the expectation step, forward and backward predictions of system states are performed using the robust filter and smoother. Following this, in the maximization step, system parameters are estimated through numerical optimization. The proposed RFS-EM achieves joint estimation of the states and parameters for bilinear systems. Finally, a numerical simulation and a DC motor simulation validate the effectiveness of the proposed algorithm.

Keywords
Author Keywords
Heavy-tailed noiseBilinear systemParameter estimationState estimationRobust filterStudent's t distribution

Keywords Plus
PARAMETER-ESTIMATIONIDENTIFICATIONOPTIMIZATION

5-Simulation and design of T-shaped barrier tops including periodic split ring resonator arrays for increased noise reduction

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By Qin, XC (Qin, Xiaochun) [1] ; Yang, WJ (Yang, Weijie) [1] ; Zhang, ZJ (Zhang, Zijian) [1] ; Wangari, VW (Wangari, Vicky Wangechi) [1] (provided by Clarivate) **Source APPLIED ACOUSTICS Volume 236 DOI 10.1016/j.apacoust.2025.110751 Article Number 110751 Published JUN 5 2025 Early Access APR 2025 Indexed 2025-05-11 Document Type Article**

Abstract

Road traffic flows are increasing and so are associated noise levels along highways. Simply increasing the height of conventional noise barriers is not a sustainable way of meeting the greater requirements for noise control. This paper reports the design of two types of structures involving either horizontal or vertical cylindrical split ring resonators placed on a T-shaped noise barrier to improve its acoustical performance. These structures exploit mechanisms of Bragg scattering, cavity resonance, and sound absorption by cylindrical microperforated plate inserts. The designs are based on 2D and 3D finite element models and measured frequency spectra of highway noise. They have been validated by full scale tests in a semi-anechoic laboratory. The structures with uniformly reducing numbers of horizontal resonators in successive rows and uniformly reducing heights in successive rows of vertical resonators are found to offer the best overall noise reduction. Microperforated cylindrical inserts are found to increase the reduction offered by the horizontal resonator arrangements by 5 dB near 2 kHz, while having little effect on the performance of the arrays of vertical resonators.

Keywords
Author Keywords
Noise barrierUniform arrayTraffic noiseMicro-perforated plate

Keywords Plus
ACOUSTIC PERFORMANCESOUND-TRANSMISSIONSONIC CRYSTALSATTENUATION