

Fiber Optic Sensing Pattern Recognition



Article Overview

Pattern recognition in fiber optic sensors leverages advanced deep learning algorithms to classify signal patterns from distributed sensing systems, enhancing accuracy and enabling real-time monitoring.

Overview of Fiber Optic Sensor Pattern Recognition

Distributed fiber optic sensors (DFOS) and distributed acoustic sensors (DAS) detect physical events such as vibrations, intrusions, or structural changes along the length of an optical fiber. Pattern recognition algorithms are applied to the sensor signals to identify and classify these events accurately, which is critical for applications like perimeter security, infrastructure monitoring, and smart environments .

Key Techniques

1. Interferometric Sensing with TFNN: An innovative approach combines a Mach-Zehnder interferometer (MZI) with a time forest neural network (TFNN). The MZI captures high-resolution signal variations, while the TFNN processes time-series data using interval-based feature extraction and dense neural network layers. This method improves classification accuracy and computational efficiency compared to conventional 1D convolutional neural networks (1D-CNNs), achieving an 8.43% higher accuracy in intrusion detection tasks . 2. Deep Convolutional Neural Networks (CNNs) for DAS: For distributed acoustic sensors, CNNs are effective in learning spectro-temporal features from vibration signals. Enhancements include:

- Intensity and Phase Stacked CNN (IP-CNN): Utilizes both intensity and phase infor...

Article Content

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A deep learning model enabled multi-event recognition for ...

To fully take advantage of the information contained within the large number of unlabeled samples, which were

Jul 05, 2026

Artificial Intelligent Pattern Recognition for Optical Fiber ...

In this paper, we present an integrated approach to improve measurement efficacy of fiber optical distributed acoustic sensing (DAS)

Oct 06, 2025

(PDF) Pattern recognition in distributed fiber-optic acoustic sensor ...

Pattern recognition in distributed fiber-optic acoustic sensor using an intensity and phase stacked convolutional neural

Sep 29, 2025

TF-HTPA: Distributed Optical Fiber Sensing Pattern Recognition ...

Abstract: Distributed fiber-optic sensing (DFOS) systems face two critical challenges in event recognition applications:

Jan 09, 2026

Application of machine learning for signal recognition in distributed ...

Abstract Coherent Rayleigh scattering-based distributed fibre optic sensing technology enables real-time acquisition

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Distributed fiber optic sensing signal recognition based on class ...

In order to solve the problem of failing to accurately identify new events due to the inability to obtain all samples at once

May 12, 2026

Pattern Recognition in Distributed Optical Fiber Acoustic Sensing

A stacked long short-term memory neural network (Dual-LSTM) is proposed to address the challenges of strong noise and

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High-Precision Pattern Recognition in Distributed Polarization

High-Precision Pattern Recognition in Distributed Polarization Coupling Systems

Abstract: In recent years, the distributed fiber optic

Aug 31, 2025

Research on pattern recognition technology for a highperformance ...

In the end, the feature values of optical fiber vibration sensor such as frequency range, amplitude and waveform

Mar 28, 2026

Event Pattern Recognition of Distributed Optical Fiber Sensing System ...

Event pattern recognition technology has become an important research direction of distributed fiber optic vibration sensors. In this

Nov 03, 2025

Pattern Recognition for Distributed Optical Fiber Vibration Sensing: A ...

This review explores pattern recognition techniques for distributed optical fiber vibration sensing, highlighting advancements and

Sep 18, 2025

A comprehensive bibliometric analysis of signal processing and

Unlike other researchers, this paper aims to summarize the DOFS signal processing and pattern recognition in the

Nov 23, 2025

Multi-Dimensional Distributed Optical Fiber Vibration Sensing Pattern ...

Multi-Dimensional Distributed Optical Fiber Vibration Sensing Pattern Recognition Based on Convolutional Neural Network . Acta

Feb 06, 2026

Deep Learning Applications in Optical Fiber-Based Sensing Systems

The focus of this chapter is implementation of deep learning for signal processing, pattern recognition, and anomaly

Aug 22, 2025

Multi-dimensional feature extraction method for distributed optical ...

Aiming at the pattern recognition of disturbance events in distributed optical fiber sensing systems, a multi

Mar 08, 2026

Intelligent Pattern Recognition Using Distributed Fiber Optic Sensors ...

Abstract: Distributed fiber optic sensors (DFOSs) have become increasingly popular for intrusion detection, particularly in outdoor

Jun 12, 2026

Distributed Optical Fiber Sensing Intrusion Pattern Recognition Based ...

This article proposes an intrusion pattern recognition scheme based on Gramian Angular Field (GAF) and

Aug 31, 2025

Research on the feature extraction and pattern recognition of the ...

Abstract In this paper, feature extraction and pattern recognition of the distributed optical fiber sensing signal have

Mar 21, 2026

Application of machine learning for signal recognition in distributed ...

The authors provide a comprehensive review of signal feature extraction and pattern recognition techniques applied in

Jul 14, 2026

Deep learning for highly efficient curvature recognition using fiber ...

A flexible fiber-optic sensor enabled by deep learning is proposed and experimentally demonstrated for highly efficient

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High Accuracy Intrusion Pattern Recognition using a Dual-Stage ...

A dual-stage-recognition network combined with the fiber optic DAS system is designed to realize a high accuracy

Jul 14, 2026

Machine Learning Applications in Optical Fiber Sensing: A ...

The inclusion of pattern recognition, monitoring, wireless sensor networks, and fault detection in Quadrant III reflects

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Deep learning-based approach for high spatial resolution fibre shape ...

Although the state-of-the-art fiber optic shape sensing mechanisms can provide sub-millimeter spatial resolution for off

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For more information, pricing, or custom solutions, please contact us:

Website: <https://www.greatpremiersolutions.co.za>

Email: sales@greatpremiersolutions.co.za

Phone: +27 82 914 3675

Address: Unit 5, Silicon Heights, 22 Electron Avenue, Cape Town, 8001, South Africa

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