Compressive Sensing Based Algorithms For Electronic Defence Signals And: Unlocking Advanced Signal Processing Techniques

Compressive Sensing Based Algorithms for Electronic Defence (Signals and Communication Technology)

by Irene Noguer

5 out of 5

Language	: English
File size	: 8726 KB
Text-to-Speech	: Enabled
Screen Reader	: Supported
Enhanced typesetting	: Enabled
Print length	: 277 pages

FREE DOWNLOAD E-BOOK

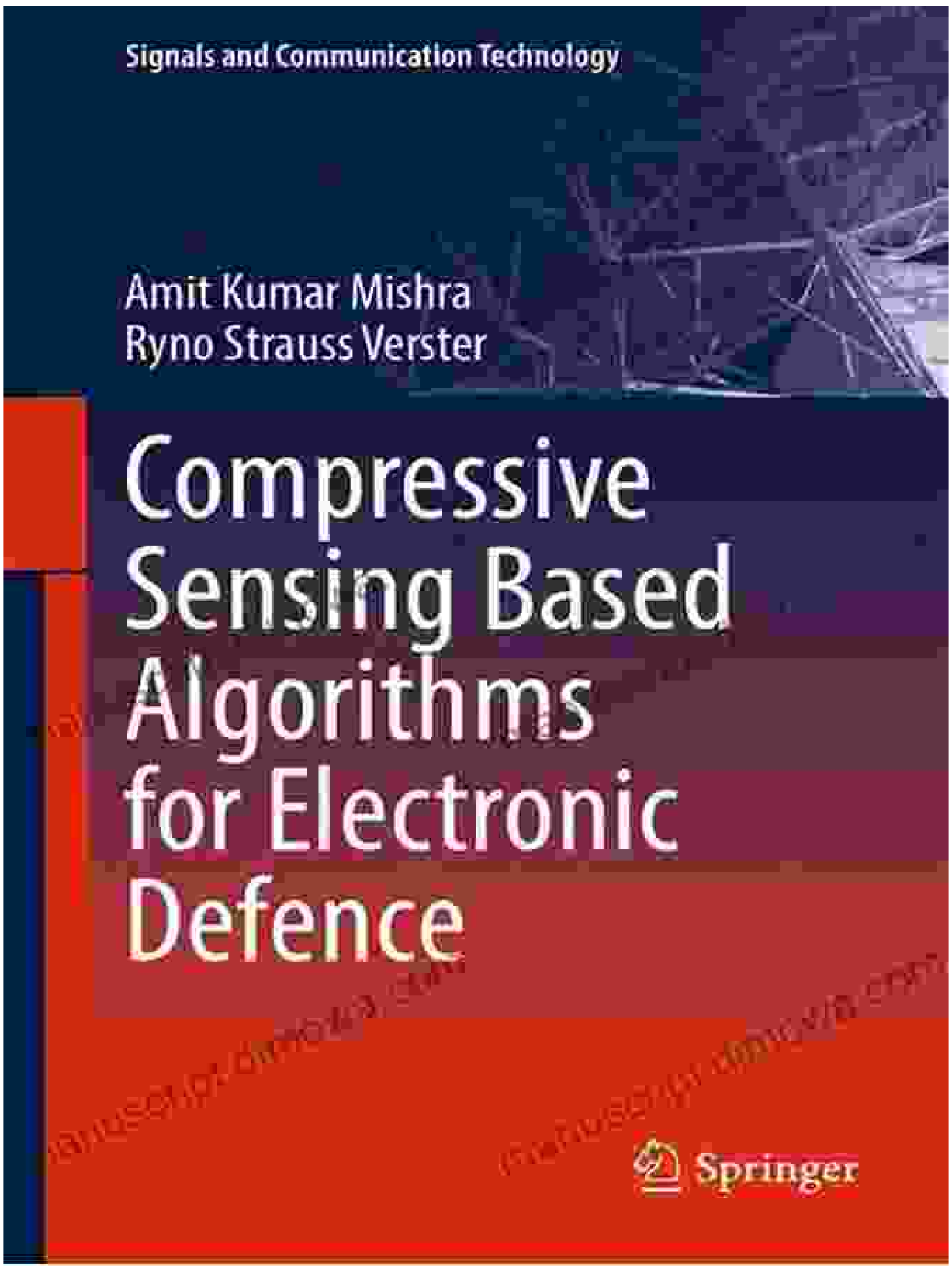
In the realm of electronic defence, the ability to accurately detect, classify, and localize electronic signals is paramount. Compressive sensing (CS) has emerged as a revolutionary signal processing technique that empowers electronic defence systems with unprecedented capabilities. This article provides a comprehensive overview of CS-based algorithms for electronic defence signals, exploring their theoretical foundations, practical applications, and cutting-edge research directions.

Theoretical Foundations

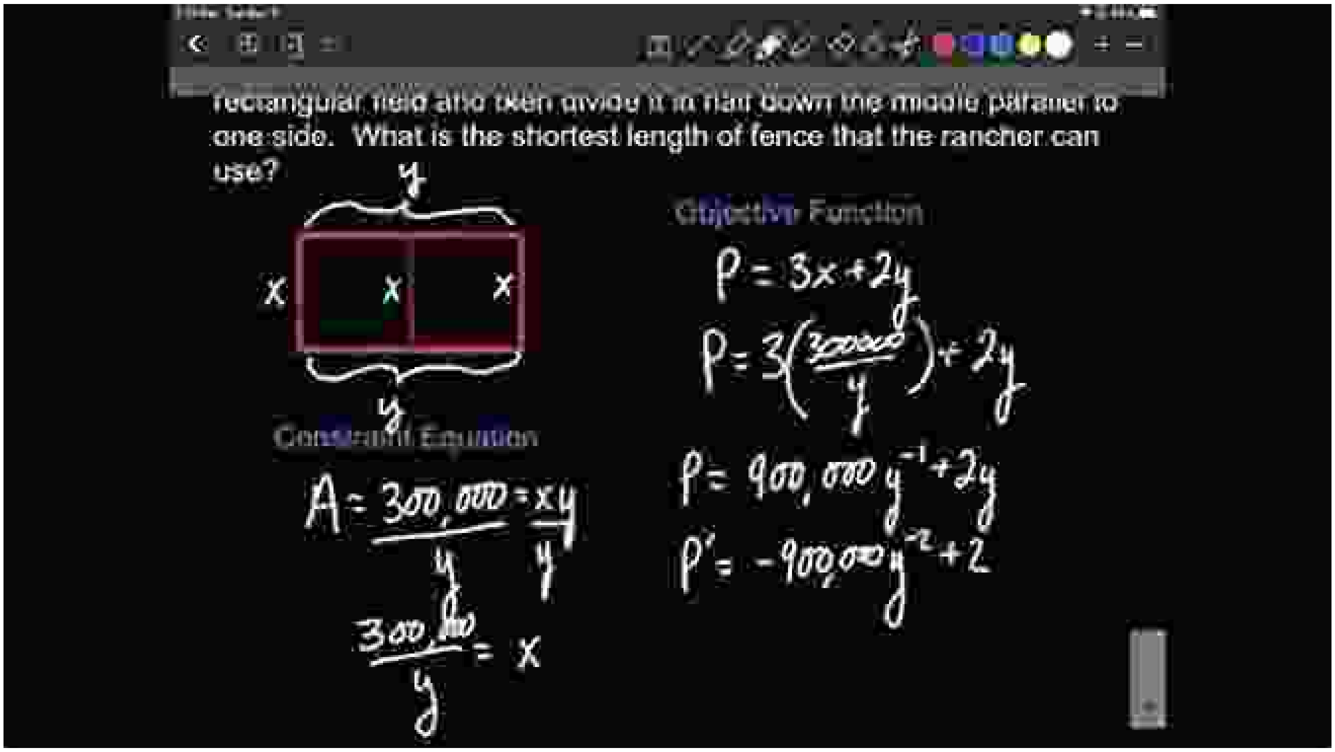
CS is a signal reconstruction technique that exploits the inherent sparsity of signals. It relies on the principle that a sparse signal can be accurately reconstructed from a small number of non-adaptive linear measurements.

This is achieved through random projections, which transform the signal into a compressed domain where the sparse structure is accentuated.

Formally, a signal \mathbf{x} of length N is considered sparse if it has only K non-zero elements, where K . CS aims to reconstruct \mathbf{x} from M measurements obtained through a sensing matrix A, where M . The compressed measurements \mathbf{y} can be expressed as:



Reconstruction involves solving the following optimization problem:



where ||\cdot||_1 denotes the \ell_1 norm.

Applications in Electronic Defence

CS-based algorithms have found widespread applications in electronic defence, including:

- **Radar signal detection:** CS can detect weak radar signals amidst noise by exploiting their sparse nature in the time-frequency domain.
- **Signal classification:** By capturing the unique sparsity patterns of different signal types, CS algorithms can effectively classify electronic signals, such as radar, sonar, and communication signals.
- **Target localization:** CS enables accurate localization of electronic signal sources by exploiting the spatial sparsity of the target's

signature in the sensor array domain.

Cutting-Edge Research

Ongoing research in CS-based algorithms for electronic defence signals focuses on:

- **Robust reconstruction algorithms:** Developing algorithms that can handle noisy and incomplete measurements, ensuring reliable signal recovery in challenging environments.
- **Adaptive sensing schemes:** Designing adaptive sensing matrices that can optimize the measurement process based on the signal characteristics, improving reconstruction accuracy and efficiency.
- **Compressed sensing for cognitive electronic warfare:** Exploring the integration of CS with cognitive electronic warfare techniques to enhance situational awareness and decision-making in complex electromagnetic environments.

Compressive sensing-based algorithms have revolutionized electronic defence signal processing, providing unparalleled capabilities for signal detection, classification, and localization. These algorithms exploit the sparse nature of electronic signals, enabling efficient and robust signal recovery from a reduced number of measurements. Ongoing research in this field promises even more advanced algorithms that will further enhance the performance of electronic defence systems.

References

1. E. J. Candès and M. B. Wakin, "An to compressive sampling," IEEE Signal Processing Magazine, vol. 25, no. 2, pp. 21-30, Mar. 2008.

2. D. L. Donoho, "Compressed sensing," IEEE Transactions on Information Theory, vol. 52, no. 4, pp. 1289-1306, Apr. 2006.

3. A. M. Bruckstein, D. L. Donoho, and M. Elad, "From sparse solutions of systems of equations to sparse modeling of signals and images," SIAM Review, vol. 51, no. 3, pp. 443-474, 2009.

Compressive Sensing Based Algorithms for Electronic Defence (Signals and Communication Technology)

by Irene Noguer

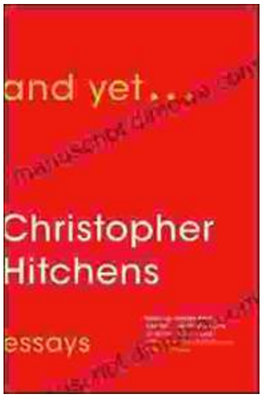
★★★★★ 5 out of 5

Language	: English
File size	: 8726 KB
Text-to-Speech	: Enabled
Screen Reader	: Supported
Enhanced typesetting	: Enabled
Print length	: 277 pages

FREE DOWNLOAD E-BOOK

Step Onto the Dance Floor of Spanish Fluency with "Bailando Con Las Palabras En Una Discoteca"

Are you ready to take a spin on the Spanish language dance floor? Get ready to salsa through conversations with confidence with "Bailando Con Las...



And Yet: Essays by Christopher Hitchens

A Review Christopher Hitchens was one of the most brilliant and provocative writers of our time. He was a master of the essay...