Certainly! Below is the **complete text** of the extended summaries for all **20 research papers** on **self-correcting algorithms** and **adaptive thresholding methods**, from paper 1 to paper 20.

📘 Extended Summaries of 20 Research Papers

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1. Dynamic Self-Correcting KPI Anomaly Detection (DSCAD)

Authors: Yufang Sun et al.
Publication: *Nondestructive Testing and Evaluation* (2023)
Access Link: DSCAD Paper
Summary:
This paper introduces DSCAD, a novel anomaly detection algorithm tailored for continuous monitoring of Key Performance Indicators (KPIs) like CPU usage or network traffic. Unlike conventional systems that use static thresholds or assume a Gaussian distribution, DSCAD dynamically adapts thresholds in real-time through non-parametric statistics. It includes a self-correcting mechanism to re-evaluate previously flagged anomalies using contextual time-series data. This feedback loop reduces false alarms significantly while preserving sensitivity to genuine issues. The method is especially useful in cloud and IT infrastructure, where fast and accurate fault detection is crucial for system uptime and service reliability. Its statistical flexibility allows it to work effectively across multiple domains with different data distributions.

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2. Self-Correcting Q-Learning

Authors: Rong Zhu, Mattia Rigotti
Publication: *AAAI Conference on Artificial Intelligence* (2021)
Access Link: Self-Correcting Q-Learning
Summary:
This paper addresses maximization bias in Q-learning, which leads to overestimated action values and unstable learning. To combat this, the authors propose a self-correcting version of Q-learning that incorporates confidence-weighted updates. The algorithm adjusts how much new experiences influence the Q-values based on the certainty of those values, improving both stability and convergence. It also presents a Self-Correcting Deep Q-Network (SC-DQN) variant for deep reinforcement learning. Experimental results from Atari benchmarks show that this method achieves better or more stable performance than standard Q-learning, particularly in environments with high variance or sparse rewards. This work contributes significantly to the development of robust, scalable RL algorithms.

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3. S3c-Math: Spontaneous Step-Level Self-Correction in LLMs

Authors: Yuchen Yan et al.
Publication: *ArXiv preprint* (2024)
Access Link: S3c-Math Paper
Summary:
S3c-Math is a framework that improves the reasoning ability of large language models (LLMs) by enabling them to self-correct during the intermediate steps of solving math problems. The system trains models to actively verify and refine each step before continuing, using step-level feedback mechanisms and structured training data. Unlike post-hoc correction models, S3c-Math encourages proactive identification of inconsistencies and logical errors. It significantly improves benchmark performance on math tasks like GSM8K and MathQA by reducing cumulative reasoning errors. This marks a step forward in making LLMs more trustworthy for STEM applications.

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4. Self-Adaptive Motion Alarm Algorithm

Authors: Kang Hongbo et al.
Publication: *Chinese Patent CN* (2016)
Access Link: Motion Alarm Patent
Summary:
This patent describes a motion alarm system that detects abnormal movement patterns (e.g., falling or inactivity) in real time using wearable sensors. The core algorithm dynamically adjusts detection thresholds based on the user's activity history and motion signatures. This prevents false positives due to normal activity variations while maintaining sensitivity to dangerous events. The system includes a learning component that adapts to changing behavior patterns and provides GPS integration for emergency response. It's suitable for applications in elderly care, sports monitoring, and health tracking.

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5. Self-Correcting Multigrid Solver

Author: Jerome L. V. Lewandowski
Publication: *International Journal of Computational Methods* (2006)
Access Link: Multigrid Solver
Summary:
This computational methods paper introduces a self-correcting technique in multigrid solvers for partial differential equations. It enhances numerical stability by adjusting the source term at each grid level using the residuals of previous solutions. This feedback mechanism enables the solver to better converge in challenging conditions such as ill-conditioned or nonlinear systems.

It avoids the need for finer meshes or increased iterations, making it computationally efficient. This technique is especially useful in fluid dynamics and heat transfer simulations where high accuracy and speed are essential.

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6. Amplitude Quantization for Autonomous Thresholding in Cognitive Radio

Authors: A. Onumanyi, A. Abu-Mahfouz, G. Hancke
Publication: *Physica Communications* (2020)
Access Link: Amplitude Quantization Paper
Summary:
The paper introduces a threshold detection mechanism for cognitive radio networks that does not rely on prior statistical knowledge of signal noise. Using amplitude quantization and a classification mechanism, it distinguishes signal presence in real time with minimal false detection. The algorithm learns from current and past observations, dynamically adjusting detection boundaries through heuristic corrections. It ensures high detection accuracy even under rapidly changing spectrum environments, making it ideal for adaptive spectrum sensing in smart wireless systems.

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7. Wavelet-Based Adaptive Filtering for Road Anomalies

Authors: Bello-Salau, Onumanyi et al.
Publication: *IJECE* (2019)
Access Link: Wavelet Anomaly Detection
Summary:
This paper presents a system that detects road anomalies like bumps and potholes using data from vehicle-mounted accelerometers. It utilizes wavelet transformation to filter out environmental and mechanical noise, followed by an adaptive thresholding mechanism that adjusts to the type of terrain. This dual approach enables accurate detection of real road issues while minimizing false positives from regular vibrations or tire-road interaction. The system improves road monitoring and smart city infrastructure by enabling cost-effective anomaly tracking via vehicle fleets.

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8. Global Threshold Adjustment for Cognitive Radio Spectrum Sensing

Authors: Bouhdjeur et al.
Publication: *ICAEE Conference* (2022)
Access Link: Threshold Adjustment Paper
Summary:

This algorithm uses histogram-based techniques to set detection thresholds for energy-based spectrum sensing in cognitive radios. It slices signal histograms and models local statistics to infer optimal threshold values. The method accounts for signal fluctuations and environmental noise, enabling autonomous adjustment. This is crucial for meeting real-time standards in dynamic environments like TV white space usage. Its computational efficiency and IEEE 802.22 compatibility make it suitable for practical deployment in wireless communication systems.

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9. Swarm-Optimized Self-Tuning Thresholding System

Authors: A. Onumanyi et al.
Publication: *Transactions on Emerging Telecommunications Technologies* (2020)
Access Link: Swarm Optimization Paper
Summary:
This system uses bio-inspired optimization algorithms (e.g., cuckoo search, PSO) to tune adaptive thresholds in signal detection tasks. The approach requires no prior modeling of signal or noise distributions and can handle diverse modulation types. It continuously learns from performance metrics (e.g., detection rate, false alarms) and adjusts parameters accordingly. The technique is tested across IEEE-compliant radio protocols and demonstrates excellent adaptability to changing noise conditions. It's designed for real-time, lightweight deployments in edge devices or low-latency sensor networks.

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10. Multichannel Signal Detection with Double-Threshold Correction

Authors: Xin-Zheng L.
Publication: *Radar & ECM Journal* (2009)
Access Link: Multichannel Signal Detection
Summary:
This radar signal detection algorithm improves detection of weak pulses in noisy environments using a multichannel analysis and dual-threshold strategy. The first threshold acts as a coarse filter, while the second applies stricter conditions to validate true signals. It incorporates self-correction based on pulse repetition characteristics and historical success rates. The method is hardware-efficient, allowing for FPGA/DSP implementation in real-time radar systems. It is particularly effective in military, aviation, and surveillance applications where signal reliability is paramount.

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11. PSO-Based Threshold Optimization for Fault Detection

Authors: Yao Li
Publication: *Conference Proceedings* (2019)
Access Link: [PSO Optimization Paper]
Summary:
This paper presents a Particle Swarm Optimization (PSO) approach to determine optimal fault detection thresholds for wind turbine sensors. Conventional systems rely on fixed thresholds which often fail under noise or drift. Here, the PSO algorithm models the threshold selection as an optimization task—balancing detection accuracy and false alarm rate. The system adjusts itself using historical and real-time sensor data, constantly evolving the detection criteria. The result is more accurate identification of early-stage faults with reduced false positives. It's particularly effective in industrial settings with noisy or non-stationary signals.

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12. Adaptive Signal Processing for Industrial Anomaly Detection

Authors: Vani et al.
Publication: *IEEE UPCON* (2023)
Access Link: [Industrial Anomaly Detection]
Summary:
This work combines adaptive signal filtering and machine learning to detect anomalies in industrial systems. Signals from multiple sensors are preprocessed with noise-suppression filters, then passed through a statistical engine that dynamically sets decision boundaries. An online learning model (e.g., decision trees or rule learners) improves the detection of subtle deviations caused by gradual equipment degradation or parameter drift. This hybrid method allows for continuous monitoring without requiring labeled datasets. It's practical for manufacturing plants, refineries, and chemical process industries.

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13. GPGPU-Based Conditional Dilation Thresholding for Image Detection

Authors: Morgenstern & Zell
Publication: *SPIE Proceedings* (2011)
Access Link: [GPGPU Thresholding]
Summary:
This paper develops a real-time target detection algorithm using GPU acceleration for image data. The method uses conditional dilation—a morphological operation that refines object boundaries—based on adaptive local thresholds. The algorithm dynamically adjusts these thresholds by evaluating regional intensity statistics and signal gradients. Running on GPGPU architecture, it processes high-resolution streams with minimal latency. It is ideal for surveillance, automated driving, and robotics, where high-speed and precision image analysis

are essential. The method allows spatially-varying thresholds to detect objects in non-uniform lighting or occlusion conditions.

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14. Recursive Threshold Optimization (ROHT) Using Particle Swarm

Authors: Okonkwo & Ajah
Publication: *International Journal of Wireless & Mobile Networks* (2018)
Access Link: ROHT Optimization
Summary:
The paper proposes a combination of Recursive One-Sided Hypothesis Testing (ROHT) with PSO to dynamically set decision thresholds in cognitive radio systems. ROHT is sensitive to signal variations, but its accuracy depends heavily on threshold calibration. PSO automates this process by searching the threshold space for the best trade-off between detection probability and false alarm rate. The optimized system adapts to time-varying spectrum environments, improving compliance with IEEE 802.22 standards. This methodology is applicable to any sequential detection scenario requiring quick, robust decisions under uncertainty.

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15. Smart Antenna with Adaptive CFAR Thresholding

Authors: Nour Alhariqi, Mounir Ghogho, Messaoud Barkat
Publication: *IEEE HPCC* (2012)
Access Link: Smart Antenna Paper
Summary:
This research merges adaptive Constant False Alarm Rate (CFAR) detection with smart antenna arrays for signal acquisition. The adaptive CFAR dynamically adjusts thresholds based on environmental interference, enabling consistent detection rates in variable channel conditions. Smart antennas provide beamforming and spatial filtering to suppress interference. Together, they offer precise detection of weak signals in noisy environments, such as mobile networks or radar. The system is robust against mobility, clutter, and multipath effects, making it suitable for wireless communications and battlefield applications.

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16. Two-Stage Adaptive Threshold Method for FBG Sensors

Authors: Zhaocheng Wang, Meng Wang, Rui Wang
Publication: *Sensors and Actuators A* (2022)
Access Link: FBG Adaptive Thresholding
Summary:
This paper introduces a two-stage thresholding system for Fiber Bragg Grating (FBG) sensors. The first stage applies coarse filtering to remove ambient noise, while the second stage

fine-tunes detection thresholds based on localized peak intensity. The adaptive logic compensates for environmental disturbances such as temperature drift and light source fluctuations. This dual-stage method enhances precision in wavelength detection and supports dense sensor networks. It’s useful in civil infrastructure monitoring, aerospace, and biomedical sensing.

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17. BERT and Isolation Forest for False Alarm Filtering

Authors: Mingcheng Li, Cheng Li
Publication: *Nuclear Instruments and Methods in Physics Research A* (2022)
Access Link: False Alarm Detection
Summary:
This work combines Natural Language Processing (BERT) with Isolation Forests to filter out false alarms in nuclear systems. BERT is used to analyze textual logs from operator inputs or system notes, while Isolation Forests flag outliers in quantitative data. By fusing both modalities, the system can contextualize anomalies with operator feedback and sensor values. This improves alarm accuracy and reduces alert fatigue. The methodology can generalize to other high-risk environments like aviation, chemical plants, and energy grids.

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18. Self-Correcting Navigation Using Multi-Sensor Feedback

Authors: Not listed
Publication: *Patent CN* (2020)
Access Link: Navigation Patent
Summary:
This invention provides a self-correcting navigation algorithm for autonomous systems like drones or robotic vehicles. It uses GPS, gyroscopes, and accelerometers to track movement, with error estimation logic that compares expected vs. actual paths. Detected deviations trigger real-time corrections. The method supports loss-of-signal scenarios by relying on sensor fusion for path prediction and restoration. It enhances navigation stability in urban, underground, or GPS-denied environments, crucial for autonomous safety.

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19. Fuzzy PID for Material Deviation Correction

Authors: Feng Li, Zhen Lei
Publication: *IOP Conference Series* (2021)
Access Link: Material Correction System
Summary:
This system applies a fuzzy PID control loop to correct alignment errors in flexible materials

(e.g., conveyor belts, textile lines). Traditional PID tuning is often too rigid or unstable when applied to soft materials. The fuzzy logic layer enables context-sensitive parameter adjustment depending on deviation patterns and speed. The system receives real-time position data from visual sensors, triggering motor-driven alignment arms. This allows for precision correction even in high-speed or unevenly loaded systems.

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20. Adaptive Filter-Based Sensor Fusion for Anomaly Detection

Authors: Raj Vani et al.
Publication: *IEEE Sensors Letters* (2023)
Access Link: Sensor Fusion System
Summary:
This work develops a low-latency anomaly detection algorithm using adaptive Kalman filtering and multi-sensor data fusion. Signals from different modalities (acoustic, temperature, vibration) are merged into a unified feature space. The filter dynamically adjusts to baseline shifts, sensor drift, and data dropout. The system can detect anomalies at early stages—before thresholds are visibly breached. Applications include machinery health monitoring, aviation, and smart manufacturing. It runs on embedded processors, making it suitable for edge computing environments.
