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(57) Abstract :
The present invention discloses an adaptive privacy-preserving cloud data processing system (100) integrating homomorphic encryption, federated analytics, and differential privacy within a unified hardware-software architecture. The system includes a central orchestration module (110), a homomorphic encryption engine (120) with key generation (121), encryption (122), ciphertext computation (123), and decryption (124) units, a federated analytics module (130) with secure aggregation (133), and a differential privacy controller (140). An adaptive self-optimizing control module (150) with workload analyzer (151) and parameter optimization engine (152) dynamically adjusts encryption settings for improved privacy-utility balance. A hybrid hardware-software acceleration engine (160) with a dedicated cryptographic processor (161) performs polynomial arithmetic for reduced latency. The system offers enhanced performance and is applicable across healthcare, finance, IoT, and smart city domains.

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