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(57) Abstract :
Effective insulin dosage regulation is critical for diabetes management, requiring continuous glucose monitoring (CGM) and adaptive insulin delivery. This study proposes a Bayesian Inference Model for real-time continuous insulin dosage adjustment, enhancing personalized treatment strategies by incorporating probabilistic reasoning. The model integrates CGM data with physiological parameters to dynamically predict glucose fluctuation trends and optimize insulin administration. By leveraging Bayesian updating, the system refmes predictions based on historical data, real-time sensor inputs, meal intake, physical activity, and circadian variations. Key components include Gaussian Processes for uncertainty quantification, Markov Chain Monte Carlo (MCMC) simulations for posterior distribution estimation, and Bayesian Neural Networks (BNNs) for learning complex glucose-insulin interactions. The model prioritizes hypoglycemia prevention, ensuring safety by adapting to individual variability in insulin sensitivity. Furthermore, the framework supports real-time decision-making in closed-loop insulin delivery systems, improving glycemic control while reducing patient burden. By integrating explainable AI principles, the system provides transparent recommendations, fostering trust among patients and healthcare providers. The proposed Bayesian inference approach holds the potential to significantly enhance automated diabetes management

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