NeuroShield: Personalized Adaptive Filtration and Clinical Trigger Mapping for Photosensitive Epilepsy

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One in every 20 people with epilepsy has photosensitive reflex epilepsy —2.5 million individuals for whom a flashing screen (3-60 Hz) can trigger a seizure within seconds, forcing them to live in fear of flickering screens. Beyond injury, seizures force children and adolescents into social isolation, educational exclusion, and psychological distress, with 29%developing behavioral problems. Yet current clinical management relies on avoidance, even as adolescents spend 6-8 hours daily on screens. Prior attempts, including blue-light filters, lack personalized filtration and provide no trigger data to clinicians. To address this gap, NeuroShield integrates three components: a wearable monitoring stress (GSR, heart rate), a CNN-LSTM model detecting dangerous visual flicker, and a web application filtering video content and generating clinician dashboards. Patients upload videos; a CNN-LSTM model filters frames according to the patient's photic stimulation profile, while tracking the stress level by the wearable device. All data is converted into a personalized trigger heatmap for the clinician. In a 12-week study of60 participants(ages 7-18), the detection model achieved 92.8% accuracy and 86.8% for filtration model . Physiological stress significantly decreased (stress level reduced by 40%, paired t-test: $p < 0.001$, Cohen's $d = 2.48$), moving patients from high-stress to normal-stress range. Seizures decreased 79% (IRR=0.21, 95%CI:0.14-0.29, $p<0.001$); Mann-Whitney $U = 12.5$, $p < 0.001$), restoring safe screen access for patients who previously avoided digital content. Neuroshield transforms epilepsy management from passive avoidance to , personalized digital protection, allowing children and adolescents to watch videos and connect online without fear .

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