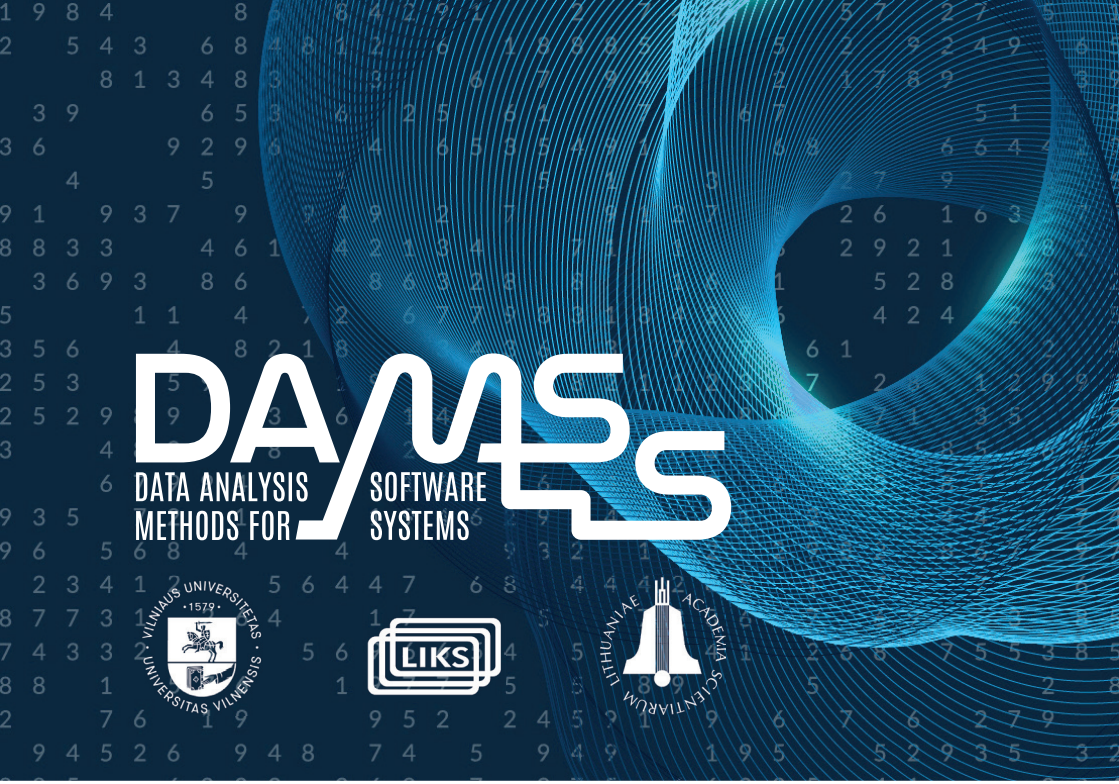

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Enhancing Cybersecurity Using Keystroke Dynamics and Data Fusion Techniques

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In response to the growing cyber threats facing critical infrastructure, this research presents a deep learning-based authentication system that uses keystroke dynamics to strengthen security against unauthorised access, including insider threats. Traditional methods often fall short in such sensitive environments, thus advanced solutions are required. Our approach integrates keystroke-based behavioural biometrics with data fusion techniques that transform keystroke dynamics data into image representations. Using a new Gabor Filter Matrix Transformation method, we transform keystroke dynamics into graphical formats, allowing enhanced pattern recognition. A Siamese neural network with a triplet loss function processes these images to accurately distinguish between authorised and unauthorised users. Our extensive experiments on datasets such as Carnegie Mellon University and GREYC-NISLAB , covering over 54,000 password samples, demonstrate that the proposed method achieves higher authentication accuracy comparing to related works. The system achieves an equal error rate value of 0.045, outperforming traditional models and offering scalable adaptability to different password types and user profiles. Empirical studies using publicly available datasets confirm the effectiveness of the approach, as indicated by a reduction in equal error rate and improved user authentication accuracy. This study highlights the need for advanced authentication methods to address insider threats and unauthorised access to critical infrastructure. By integrating deep learning and data fusion, our approach provides a scalable and accurate solution to this pressing security challenge.