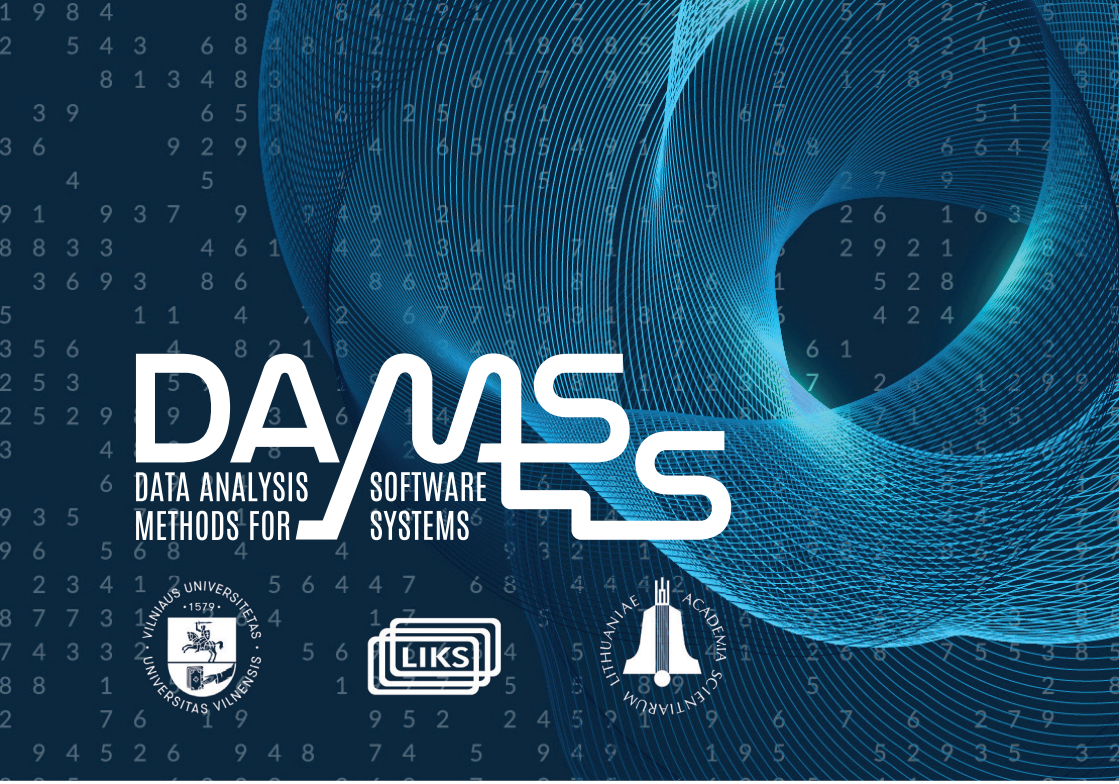

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Exploring Techniques for Diffraction Ring Detection in Molecular Research

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A substantial amount of visual data is created while conducting single-molecule experiments. Optical tweezers are a more widely used research method, and there is a notable gap in algorithms specifically designed for analysing visual data from magnetic tweezers experiments, which are executed similarly. Existing algorithms, when available, often have significant limitations, such as not being able to track a moving bead accurately. Even though tools are not readily available, some require expensive, specialised equipment purchases, making them hardly accessible.

One of the primary challenges in this study is the low temporal and spatial resolution of the images the authors work with. The visual data generated during experimentation using magnetic tweezers is often of poor quality and noisy, complicating detecting diffraction rings. These rings, critical in interpreting changes in the molecule under study, typically exhibit low contrast against the background, further complicating their detection by conventional computer vision algorithms.

This study aims to investigate and develop an algorithm capable of processing low-quality, noisy images, effectively reducing noise while preserving essential features for diffraction ring detection and parameterisation. At the end of this study, the performance and accuracy of the developed algorithm will be evaluated through experiments utilizing a diverse set of training videos. This will provide an in-depth analysis of the algorithm's effectiveness in varying conditions, particularly regarding its ability to detect and track diffraction rings accurately, which would allow us to be able to detect changes or movement of the molecule connected to the paramagnetic bead.

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