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Machine learning-based method for linearization and error compensation of a novel absolute rotary encoder

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The main objective of this work is to develop a miniaturized, high accuracy, single-turn absolute, rotary encoder called ASTRAS360. Its measurement principle is based on capturing an image that uniquely identifies the rotation angle. To evaluate this angle, the image first has to be classified into its sector based on its color, and only then can the angle be regressed. Inspired by machine learning, we built a calibration setup, able to generate labeled training data automatically. We used these training data to test, characterize, and compare several machine learning algorithms for the classification and the regression. In an additional experiment, we also characterized the tolerance of our rotary encoder to eccentric mounting. Our findings demonstrate that various algorithms can perform these tasks with high accuracy and reliability; furthermore, providing extra-inputs (e.g. rotation direction) allows the machine learning algorithms to compensate for the mechanical imperfections of the rotary encoder.
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