KALL MORRIS INC

KEEPING SPACE CLEAR FOR ALL

TumblEye: Advanced ATR for SAML through observation and translation

TumblEye is an advanced Automated Target Recognition (ATR) algorithm that detects multi-axis rotation of uncontrolled objects, resulting in a single rotational quaternion to enable in-space responses and capture.

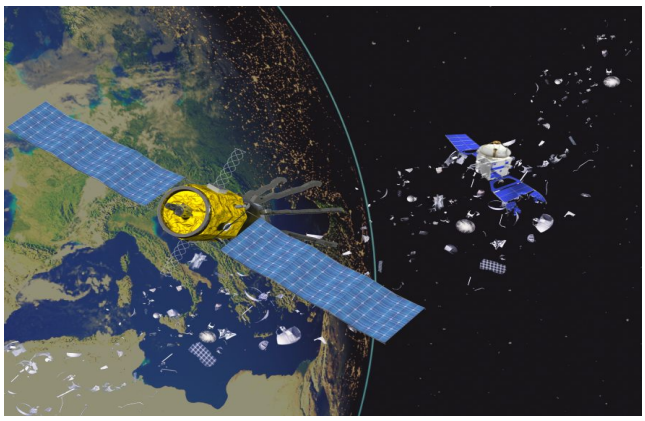
KMI has successfully developed proof-of-concepts and prototypes for the proprietary TumblEye technology. With an assisting data model, TumblEye is a machine learning algorithm to predict slight rotations of even unrecognized objects. The predictions can be provided to commercial Rendezvous, Proximity, Operations, and Docking (RPOD) algorithms and generate a rendezvous solution with minimized relative velocity.

TumblEye excels past standard autonomy by utilizing convolutional neural networks to adapt to entirely new and previously unencountered situations. The fitness function is designed with robust standards harshly weighted against providing incorrect answers, instead raising a flag that more data is needed. This advanced training, optimization, and ongoing development increases confidence in the algorithm's outputs with TumblEye ready to enable capabilities now, and continue adapting at the speed of space.

Differentiators

Capabilities

- Calculates object(s) rotational quaternion
- Processes in real time, on-approach to target
- Needs only single camera and control thrusters
- Backward compatible for integration with legacy and in-orbit assets



Pictured: TumblEye-enabled spacecraft characterizing a significant object prior to RPOD

Adaptability

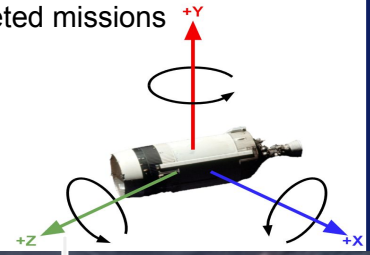
- Produce confident outputs from noisy and variable inputs
- Trained on millions of repetitions with thousands of object geometries
- Can be utilized for specific environments, mission operations, or other unique demands

Contracted Development

TRL 4 → 7

Current: Technology tested in lab environments, with partial simulations of field environment
Near term: System prototype demo in space environment
Future: Operational system with completed missions

2023: AFWERX Phase I SBIR
Machine Vision Characterization of Unrecognized Tumbling Objects



Critical Partnerships

UNITED STATES SPACE FORCE

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AFWERX

Troy M. Morris, Co-Founder & CEO
troy@kallmorris.com (815) 528-8665
Learn more: kallmorris.com

UEI: DDLRDJ2PBS71
CAGE: 8RLS0
NAICS: 541715

SIC Code: 9661
DUNS: 117618373
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