

Methodology for Algorithm-Assisted Video Object Detection Data Annotation

Single-example AI-assisted annotation that automates bounding box refinement across video datasets, cutting labeling time.

Researchers at Purdue University have developed a methodology that improves how video object detection datasets are annotated. A single example is provided by a human and then the system uses algorithms to identify similar objects across many frames. It then refines the location of each bounding box using techniques that reduce uncertainty based on a local edge detector.

This approach helps data scientists create high-quality annotations without relying on large teams of manual labelers. It is especially useful for datasets with many objects per frame and repeated patterns across time. The methodology has been tested on dense, low-contrast microscopy datasets and demonstrated strong performance in reducing annotation time and improving consistency, with potential applications in areas such as aerial imaging and urban video analysis.

Technology Validation:

The methodology was tested on video datasets with a high number of objects per frame and across many frames. A single bounding box provided by a human was used to identify similar objects using template matching. The system refined box placement using algorithms that reduced uncertainty based on a local edge detector. Validation was conducted on dense, low-contrast microscopy datasets, where the approach significantly reduced annotation time and improved consistency compared to manual workflows. While the current testing focused on microscopy, the methodology has potential applications in domains such as aerial imaging and urban video analysis. The system demonstrated reliable performance in identifying similar objects and adjusting bounding boxes to better match object boundaries. These results confirm that the technology functions as intended and is ready for integration into data annotation pipelines.

Technology ID
2025-WERE-70885

Category

Artificial Intelligence & Machine
Learning/Computer Vision &
Image Recognition
Artificial Intelligence & Machine
Learning/AI Model Optimization
& Acceleration Tools

Authors

Pranshul Sardana
Steven Wereley

Further information

Patrick Finnerty
pwoffinnerty@prf.org

View online



Advantages:

- Improves annotation speed by identifying similar objects from a single human example
- Reduces bounding box uncertainty using local edge detection algorithms
- Minimizes reliance on large teams of manual annotators and outsourced labor
- Produces consistent annotations across frames with similar object patterns
- Lowers development costs while maintaining high quality training data
- Integrates easily into existing data labeling workflows used by data scientists
- Works without pre-training or domain-specific data, enabling immediate use in new applications
- Delivers sub-pixel precision for high-density and low-contrast datasets
- Runs efficiently on CPUs, removing the need for expensive GPU hardware
- Maintains tracking stability and prevents drift across long video sequences
- Provides transparent, traceable annotations for easier verification and auditing

Applications:

- Annotation of microscopy videos with similar particle patterns
- Labeling aerial imaging datasets with dense object distributions
- High-precision annotation for microscopy and particle tracking in scientific imaging, including microfluidics and biological research
- Potential use in autonomous vehicle datasets, aerial imaging, and urban video analysis
- Training data generation for machine learning models in computer vision
- Automated annotation pipelines for research and academic datasets
- Scalable labeling for industrial inspection and surveillance footage
- Annotation support for biological imaging and cell tracking
- Dataset preparation for autonomous vehicle perception systems

Explore other available products test at [The Office of Technology Commercialization Online Licensing Store](#)

- High volume video labeling for commercial annotation platforms - Efficient bounding box refinement in large scale video archives
- Real-time annotation in environments without GPU access, such as field laboratories and low-cost research facilities
- Transparent, auditable annotation pipelines for regulated industries requiring traceable datasets

TRL: 4

Intellectual Property:

Provisional-Patent, 2025-07-10, United States

Keywords: bounding box refinement, Computer Technology, Computer Vision, data labeling, Electrical Engineering, Machine Learning, object detection, spatial algorithms, video annotation