

Visual Analysis of Motion for Camouflaged Object Detection

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Detecting camouflaged objects in videos is challenging because they blend in and barely move. Our work introduces an interactive application combining image processing, composite visual representations, and user interactions to enhance motion analysis for video camouflage detection.

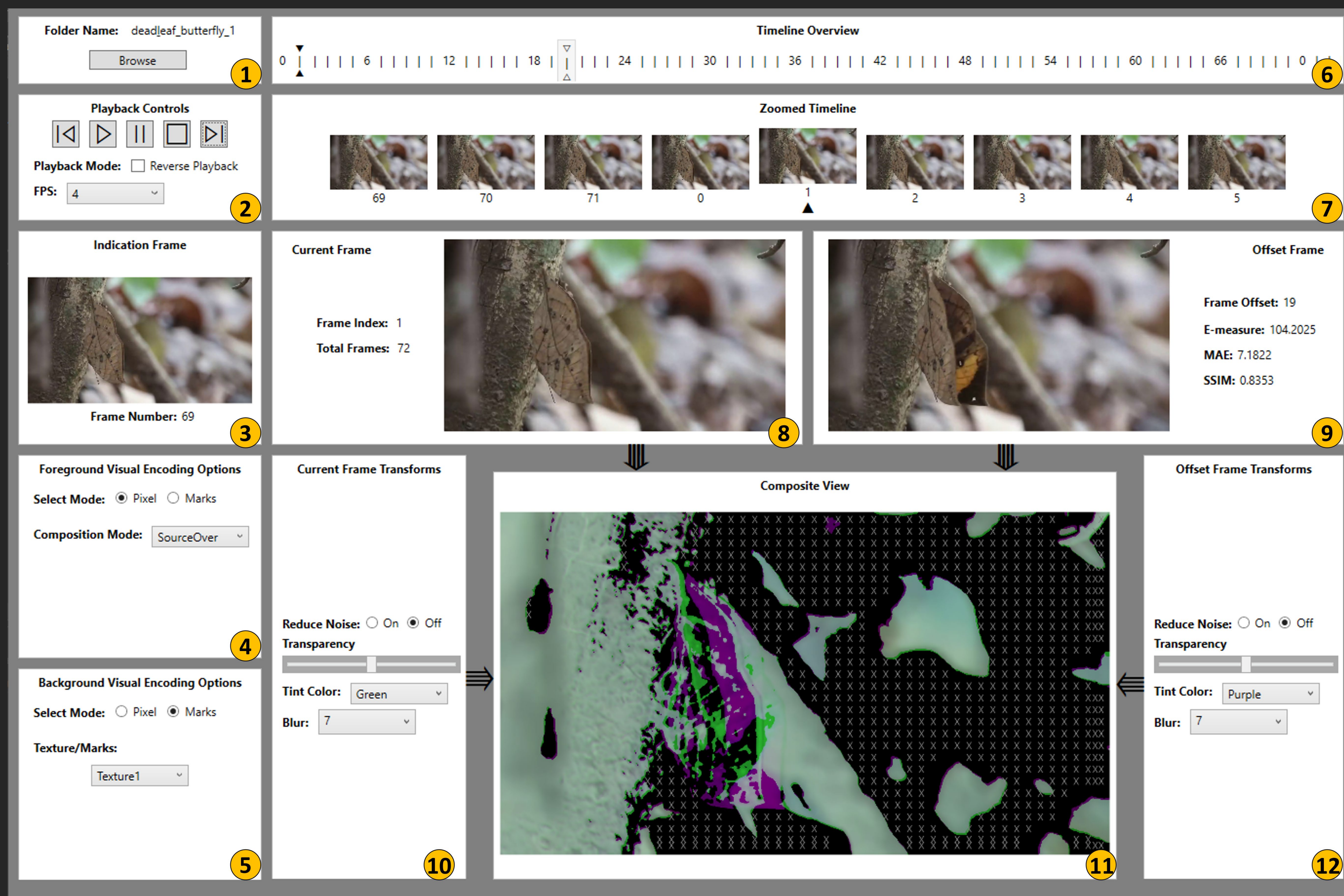
It integrates image composition methods with mixed-abstraction techniques and incorporates metrics like E-measure, Mean Absolute Error, and Structural Similarity Index Measure to quantify motion.

Our approach supports object tracking and surveillance anomaly detection, focusing on camouflaged object detection in wildlife footage.



Typical Flow of User Interaction

- 1 Load sequential image frames from a selected video.
- 2 Play or step through images forward or reverse.
- 3 View frame previews on hover over timelines.
- 4 Select foreground and background encoding options.
- 5 Choose image transformations (invert, opacity, blur).
- 6 View overview and zoomed timelines.
- 7 Select an offset frame for comparison.
- 8 Display the current playback frame.
- 9 Display selected offset frame.
- 10 Apply chosen transformations to the current frame
- 11 View composite image in the main display
- 12 Apply transformations to offset frame



Capabilities for Visual Analysis

The application implements a novel approach to visualize and analyze motion in video sequences, focusing on detecting camouflaged wildlife.

Key components include:
Image Processing
Blend Modes
Mixed-Abstraction Visual Encoding
Interactive Controls
Quantitative Metrics

This approach enables flexible, user-driven exploration of subtle movements and changes in complex, camouflaged scenarios.

Visual Encoding Examples

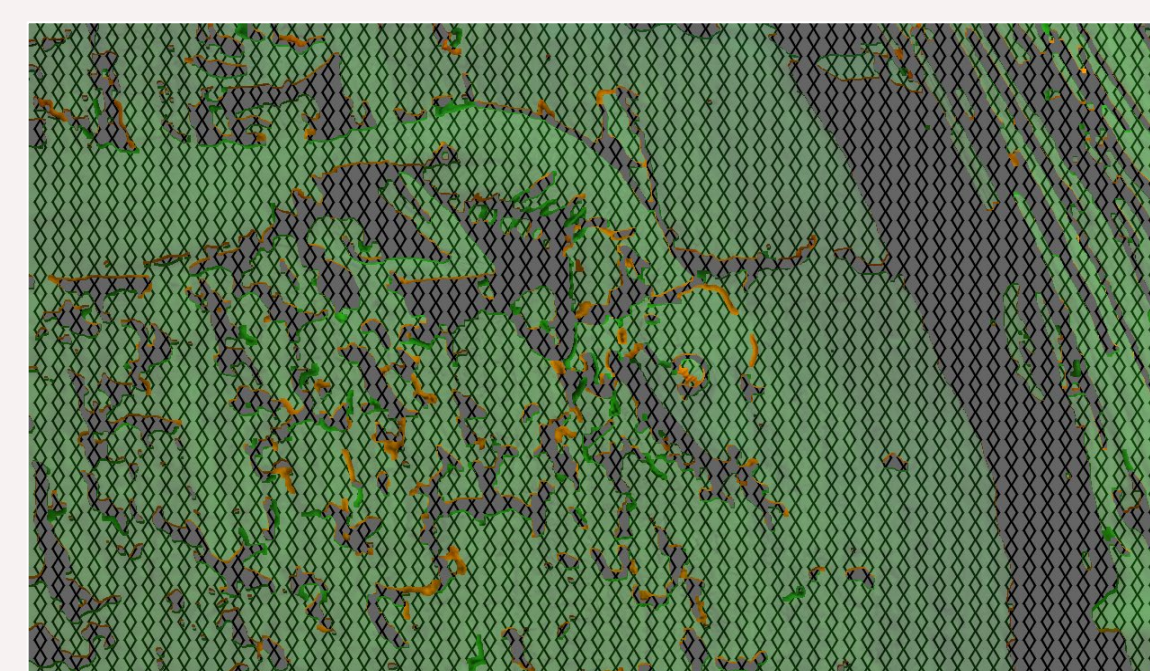


FG Marks
 BG Pixels-DestinationOver



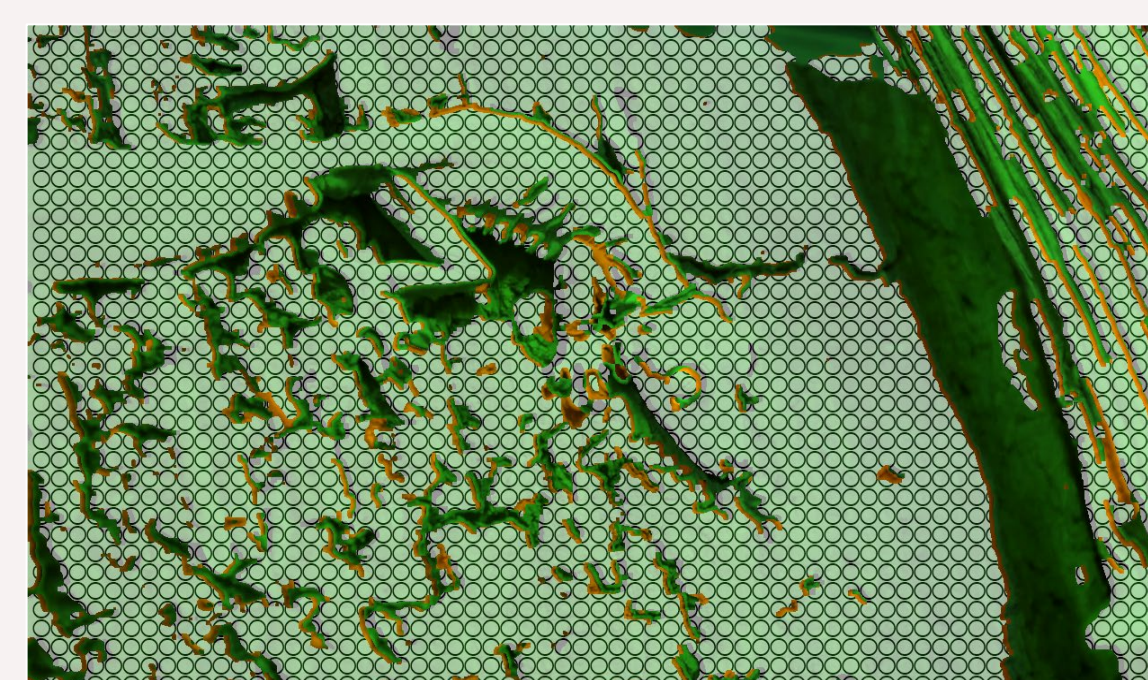
The application combines mixed-abstraction visuals, image processing, blending modes, and visual encodings to analyze camouflaged object motion in videos.

FG Pixels-XOR
 BG Marks-Double Helix



Future work will expand the application's capabilities and evaluate its effectiveness. We plan to assess performance across all motion types in the MoCA [1] dataset, develop additional background texture options, and integrate depth estimation for enhanced spatial context.

FG Pixels-SourceAtop
 BG Marks-Circle



Efforts to improve processing efficiency for high-resolution videos are ongoing. We will compare our method with other camouflage detection approaches and explore potential applications in fields requiring detailed motion analysis.

The application offers a range of visual encoding options for both foreground (FG) and background (BG) elements, designed to enhance camouflaged object detection.

This work explores the integration of image processing, composite visual representation, and interactive visualization to enhance camouflaged object detection. By supporting flexible interactive selection of layered rendering and visualization modes, we aim to improve motion analysis for potential use in surveillance, monitoring, and wildlife research. The approach shows promise in assisting with camouflaged object segmentation, opening avenues for further research in this field.

Reference: [1] Lamdouar, H., Yang, C., Xie, W., & Zisserman, A. (2020). Betrayed by motion: Camouflaged object discovery via motion segmentation. In *Proceedings of the Asian Conference on Computer Vision*.

Acknowledgments

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