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Project Page

AdaGaR: Adaptive Gabor Representation for Dynamic Scene Reconstruction

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Motivation

Problem:

- Gaussian-style explicit representations behave like low-pass filters, blurring high-frequency texture in dynamic videos.

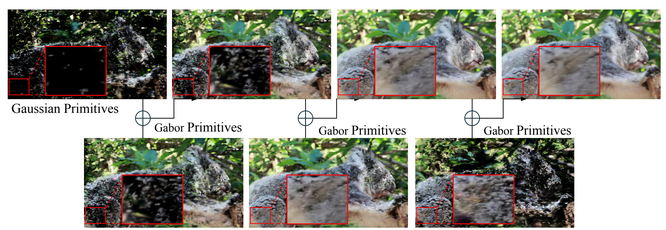
Motivation:

- Weak temporal constraints can cause flicker, tearing, and interpolation artifacts, limiting editing and view-synthesis applications.

Introduction

Contributions:

- Adaptive Gabor primitives learn when to behave like smooth Gaussians or high-frequency Gabor kernels.
- Energy compensation, depth/flow supervision, and adaptive initialization stabilize detail reconstruction.
- Cubic Hermite splines with curvature regularization produce continuous motion for interpolation and editing.



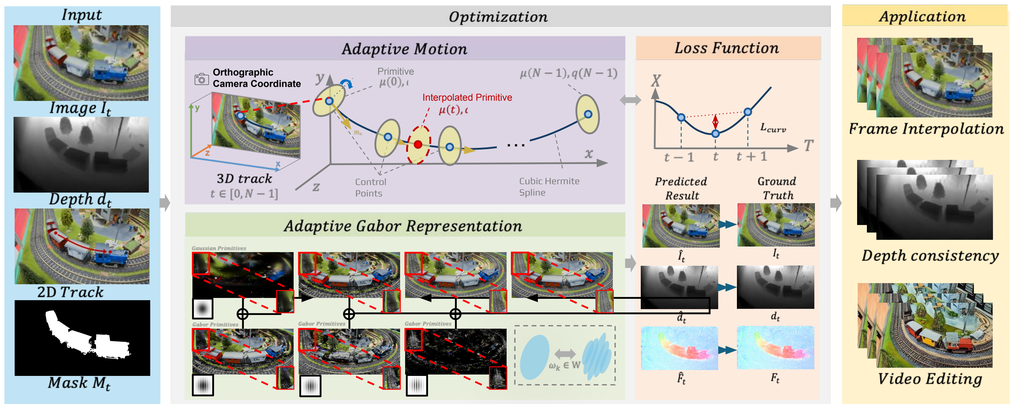
Dynamic scenes need primitives that can adapt their frequency content: Gaussian-like when stability is needed, Gabor-like when fine texture must be recovered.

Method

Overview:

- AdaGaR represents a monocular dynamic scene with adaptive Gabor primitives that preserve fine textures, while using curvature-regularized spline motion to maintain temporally smooth and stable reconstruction.

Our Proposed Framework:

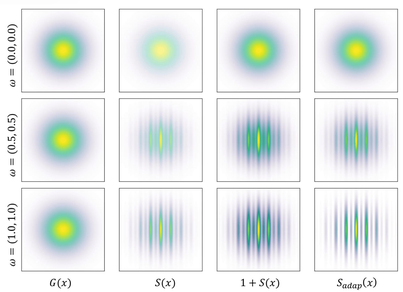


Adaptive Gabor Representation:

$$\mathcal{G}_{\text{Gabor}}(\mathbf{x}) = \exp\left(-\frac{1}{2}||\mathbf{x}-\boldsymbol{\mu}||^2_{\boldsymbol{\Sigma}^{-1}}\right) S_{adap}(\mathbf{x}),$$

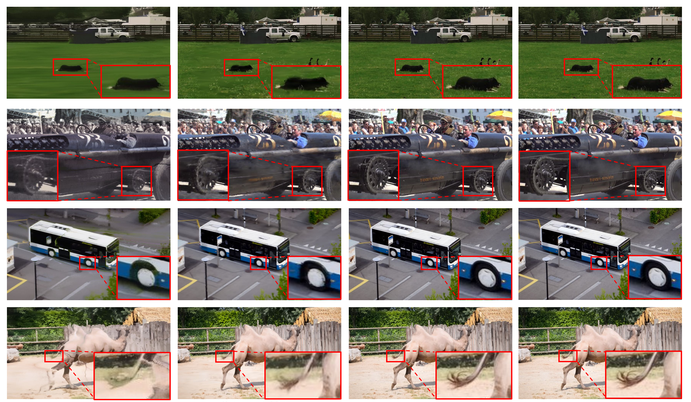
$$S_{adap}(\mathbf{x}) = b + \frac{1}{N}\sum_{i=1}^{N} \omega_i \cos(f_i \langle \mathbf{d}_i, \mathbf{x} \rangle),$$

$$b = \gamma + (1-\gamma)\left(1 - \frac{1}{N}\sum_{i=1}^{N}\omega_i\right)$$

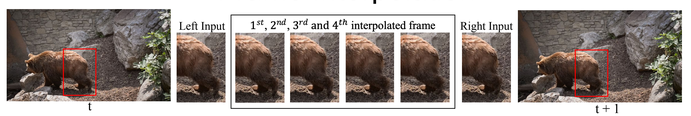


Experiments

Video Reconstruction Comparison



Frame Interpolation



(a) Video Editing (b) Stereo ViewSynthesis