Distribution Fields for Robust Object Tracking

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Motivation

- Problem ?
  Object tracking under
  - Occlusion
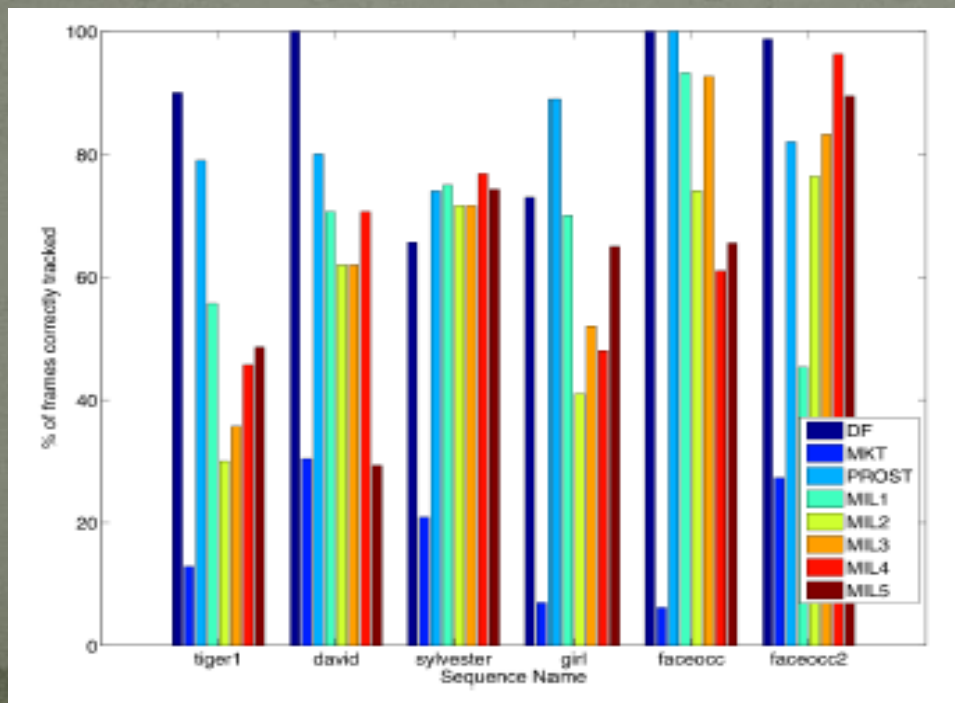
Motivation

- Problem ?
  Object tracking under
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  - Illumination Changes

Motivation

- Problem ?
  Object tracking under
  - Occlusion
  - Illumination Changes
  - Appearance Changes

Earlier Work

- Template Matching
- Optical Flow
- Multiple Kernel Tracker
- MIL (Online Multiple Instance Learning)tracker -2009
- PROST (Parallel robust online simple tracking) tracker -2010

Comparison with current state of art
Longer the better

Features

- Online Learning
- Local search method with large Basin of Convergence
- Generalized model

Framework
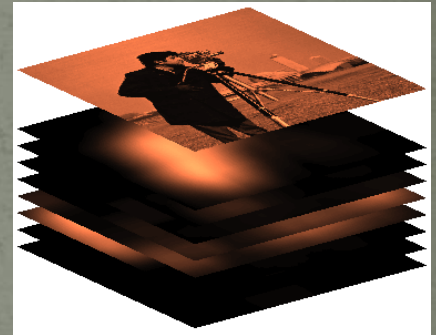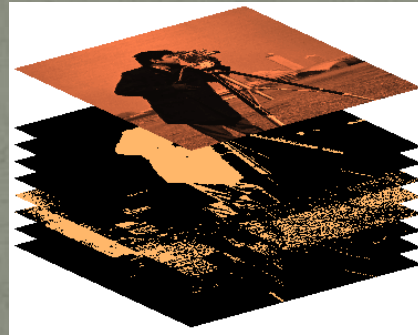
Patch initialization

Feature Space : Image Intensity

Window initialization across the object of interest in First Frame,

Framework

| Patch initialization | → | DF Model Generation of Patch |

Source- Laura Sevilla-Lara and Erik Learned-Miller.**Distribution Fields for Tracking** *IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2012.*

- Exploding : A single image is split into n number of layers where each layer contains similar intensity pixels   -n is the number of intensity bins

- Smoothing : A Gaussian kernel is used to smooth in each layer while another kernel is used to smooth across layers. Now intensity in each layer represents the probability of finding a particular intensity near that pixel

Framework

Patch initialization	DF Model Generation of Patch	Estimate Region of Interest (ROI) in next frame and create DF model of that ROI
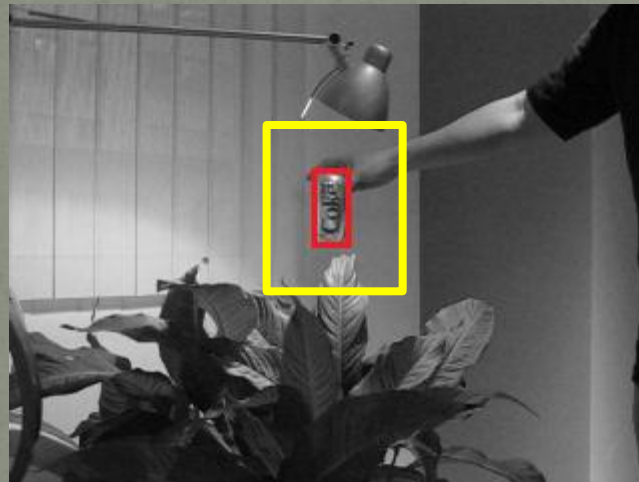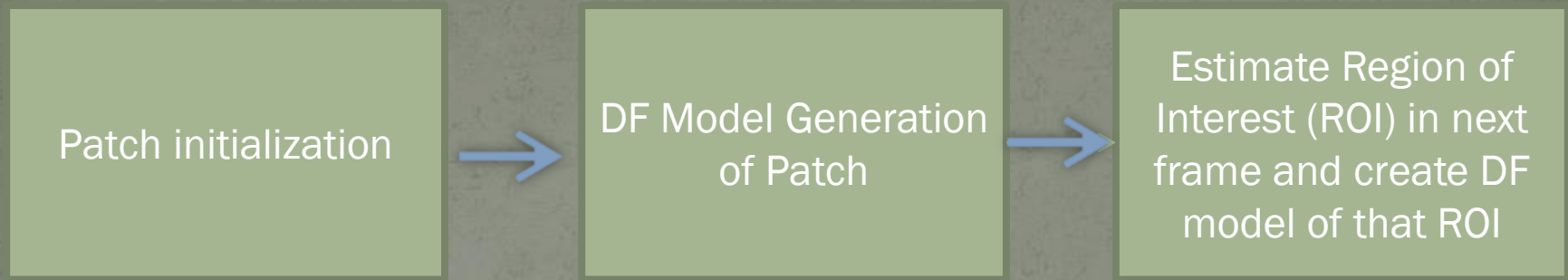
A estimation of ROI is made based on a motion model that uses previous frame motion vector, object window and kernel size.

Framework

Patch initialization → DF Model Generation of Patch → Estimate Region of Interest (ROI) in next frame and create DF model of that ROI → Matching DF model of ROI with Target model of Patch
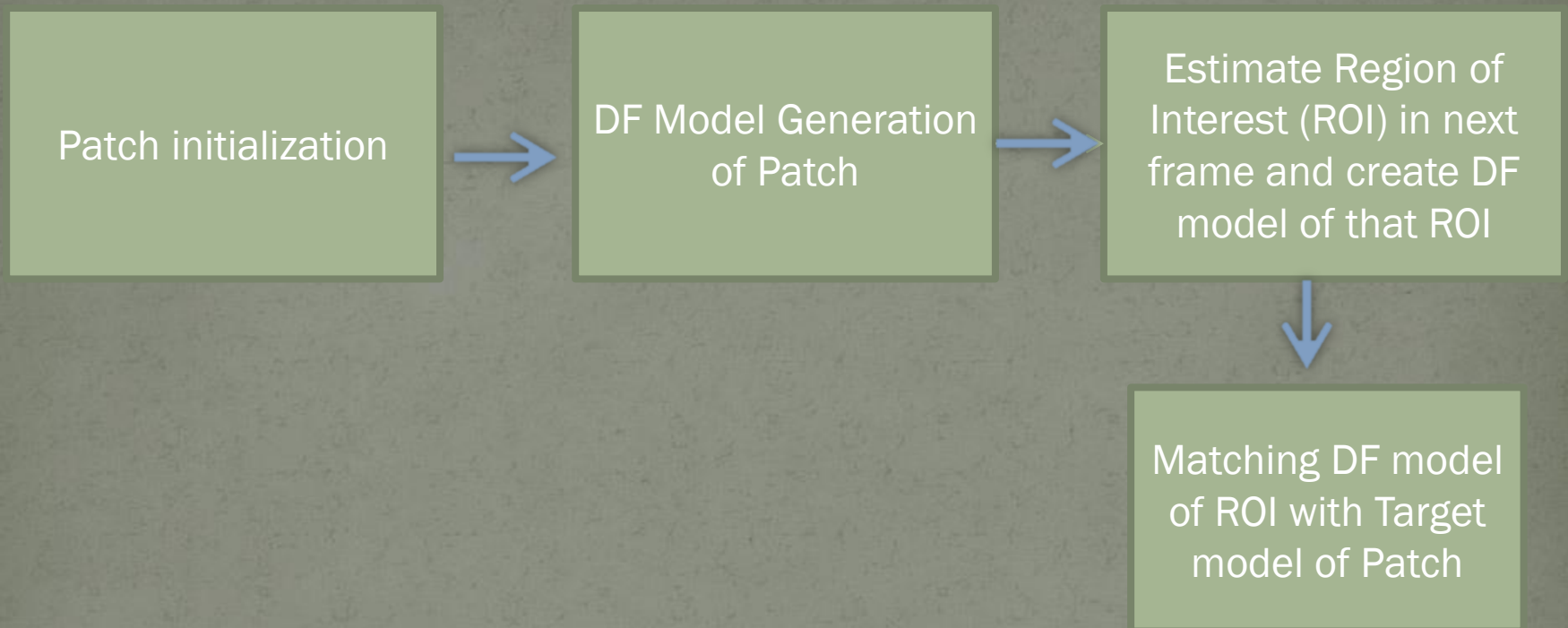
Implemented using Gradient descent and amount of matching is calculated using L1 Distance

L1 Distance is sum of absolute differences among the source and target image pixels

Framework

```
Patch initialization  →  DF Model Generation
                          of Patch
                                              →  Estimate Region of
                                                 Interest (ROI) in next
                                                 frame and create DF
                                                 model of that ROI
                                                          ↓
Updating Target    ←  Matching DF model
model of Patch        of ROI with Target
                      model of Patch
```
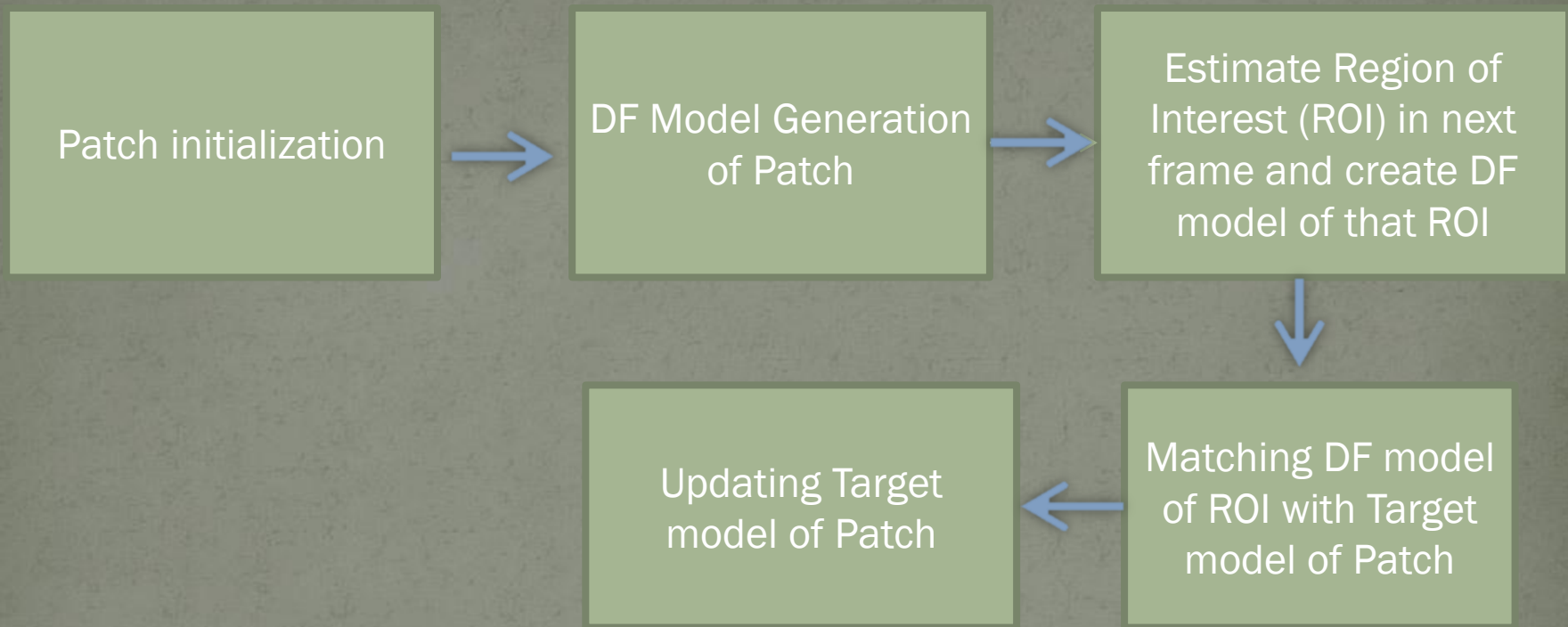
Target model is updated by adding a weighted component of current DF with previous model

Updating the initialization point and motion vector

Framework


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┌─────────────────────┐      ┌─────────────────────┐      ┌─────────────────────┐
│                     │      │                     │      │  Estimate Region of │
│ Patch initialization│  →   │  DF Model Generation│  →   │  Interest (ROI) in  │
│                     │      │      of Patch       │      │  next frame and     │
│                     │      │                     │      │  create DF model of │
│                     │      │                     │      │     that ROI        │
└─────────────────────┘      └─────────────────────┘      └─────────────────────┘
                                                                     │
                                                                     ↓
              ┌─────────────────────┐      ┌─────────────────────┐
              │                     │      │  Matching DF model  │
              │  Updating Target    │  ←   │  of ROI with Target │
              │   model of Patch    │      │   model of Patch    │
              │                     │      │                     │
              └─────────────────────┘      └─────────────────────┘
```
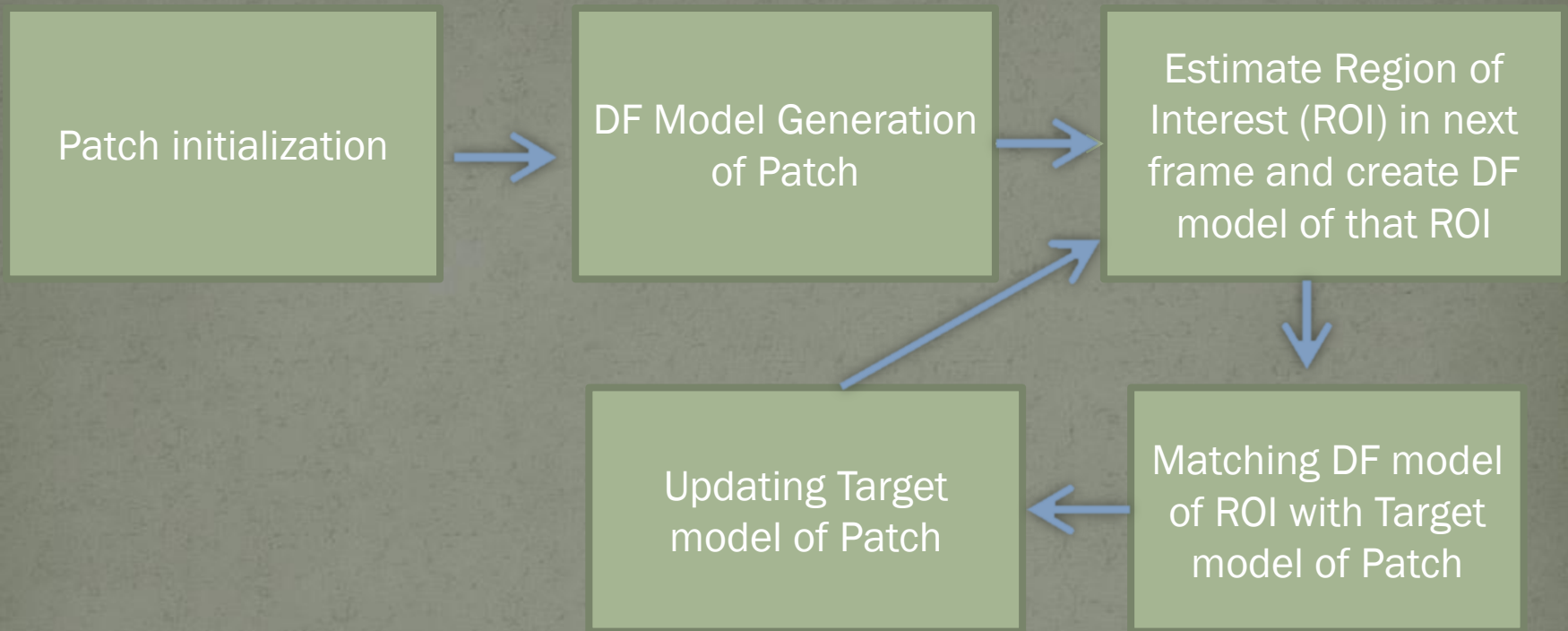
Same steps are iterated for all other upcoming frames
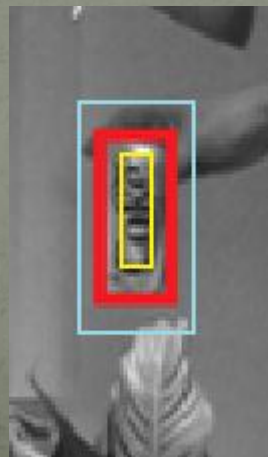
Sample Results

Our Contributions

- ## Scale Invariance:

  Target window size gets regularly rescaled to tightly bound the targeted object

  Our Approach:

  We scale the target model to different scales and find their match with ROI's of different scales and choose the best matching ROI

Evaluation

- Modified algorithm run on our dataset

References

- Distribution Fields –

  Laura Sevilla-Lara, Erik Learned-Miller 2011

- Laura Sevilla-Lara and Erik Learned-Miller.
  Distribution Fields for Tracking
  IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2012.

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Thank you