

UE COMPVISIO Final Presentation

Topic B : PatchMatch

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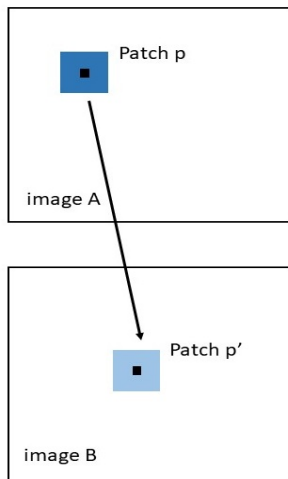
1 Context

2 Methodology

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Nearest-Neighbor Field (NNF)



- **Problem:** For all patch p in image **A**, find the most similar patch p' in image **B**.
- The set of all the mappings $p \mapsto p'$ is called the *Nearest-Neighbor Field*.
- But the NNF is unknown and has to be estimated.
- **Solution:** PatchMatch algorithm to estimate the NNF between the two images.

PatchMatch algorithm (overview)

- Initialization: Random patch assignments $p \mapsto p'$.
- Iterations of *propagation* followed by *random search*.

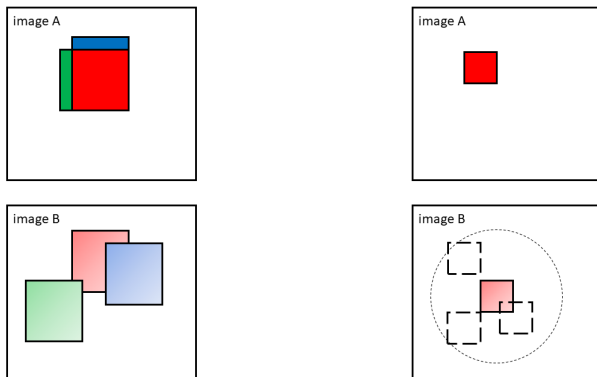


Figure: Propagation (left) and random search (right) applied at each patch, at each iteration.

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PatchMatch for object tracking

- Step 1: Apply PatchMatch between reference image and target image.
- Step 2: Use the previously pixel mappings $p \mapsto p'$ to propagate the reference mask.

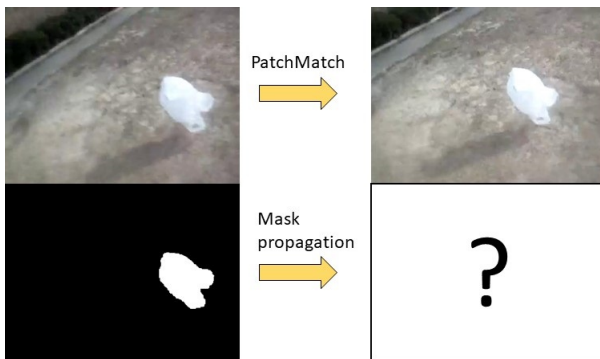


Figure: Reference image on the left, next image on the right. The next mask has to be estimated.

Integration methods

Problem: How to choose the reference image and the reference mask ?

- Solution 1: **Direct integration.** Always use the first image as reference
- Solution 2: **Sequential integration.** Always use the previous image as reference
- Solution 3: **Hybrid integration.** Update the reference image every given number of steps

Implementation details

Implemented solutions to decrease the running time of PatchMatch:

- Parallelization of PatchMatch implementation
- No random initialization. The initial NNF is set to identity because of small displacements of the mask
- Smaller region to explore in the random search step

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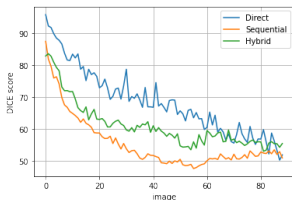
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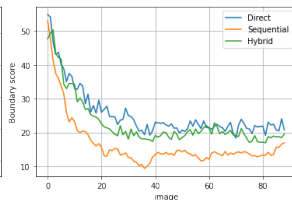
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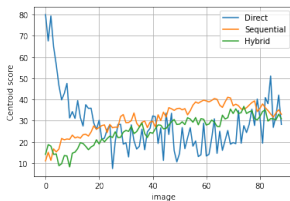
Metrics obtained with rhino images



(a)



(b)



(c)

Figure: Rhino images results. (a) Dice score, (b) Boundary score, (c) Centroid score.

Metrics obtained with bear images

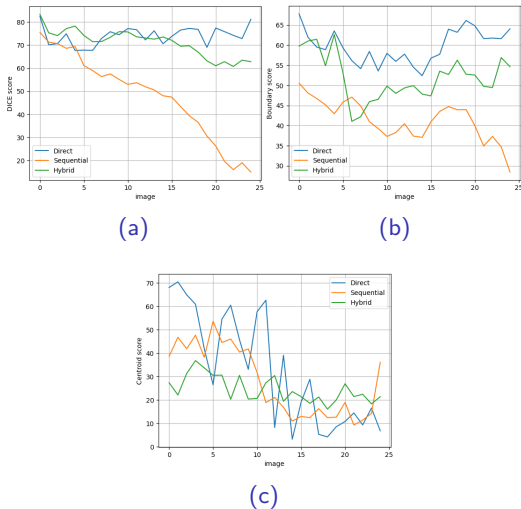


Figure: Bear images results. (a) Dice score, (b) Boundary score, (c) Centroid score.

Metrics obtained with bags images

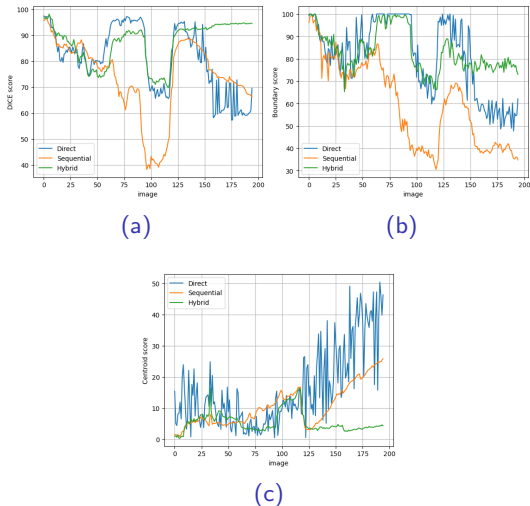


Figure: Bear images results. (a) Dice score, (b) Boundary score, (c) Centroid score.

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Perspectives

- Use SuperPatchMatch algorithm.
- More in-depth study of the hyperparameters of PatchMatch. In particular the number of iterations and the patch size.