

Suggested DeSTIN improvements/ extensions

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DeSTIN-Internal Improvements

1. Integrate better clustering algorithm (slide 39 of Karnowski PPT) [someone at UTK is trying this]
2. Replace tabular approach with supervised learning (slide 40 of Karnowski PPT) [someone at UTK is trying this, and we know it works because Binatix HDRN works this way], ultimately with a sup. learning method that can use background knowledge from long-term memory (e.g. MOSES)
3. Reimplement DeSTIN in CUDA for GPU supercomputer [this was Michel Drenthe's proposed project]
4. Use supervised learning to identify the internal DeSTIN states corresponding to specific (externally labeled) inputs
5. Do clustering on internal DeSTIN states (after exposure to a wide variety of stimuli) to discover new concepts

DeSTIN/SIFT integration

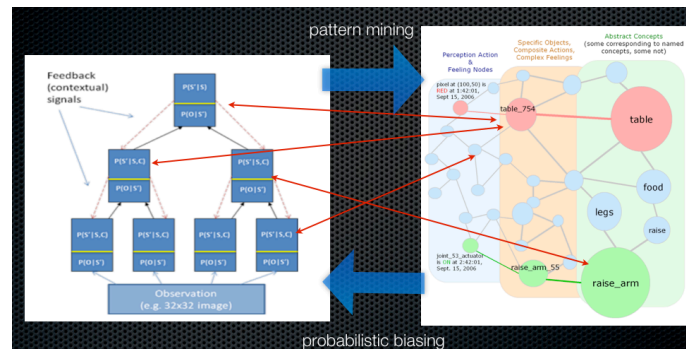


Figure 1: SIFT algorithm finds keypoints in an image, i.e. localized features that are particularly useful for identifying the objects in an image. The top row shows images that are matched against the image in the middle row. The bottom-row image shows some of the keypoints used to perform the matching (i.e. these keypoints demonstrate the same features in the top-row images and their transformed middle-row counterparts). SIFT keypoints are identified via a staged filtering approach. The first stage identifies key locations in scale space by looking for locations that are maxima or minima of a difference-of-Gaussian function. Each point is used to generate a feature vector that describes the local image region sampled relative to its scale-space co-ordinate frame. The features achieve partial invariance to local variations, such as affine or 3D projections, by blurring image gradient locations

6. Integrate with SIFT (or similar) as a preprocessor to do “attention focusing” via emphasizing important parts of the input [this may require some internal DeSTIN tweaks, e.g. I've outlined an approach in which DeSTIN is made to use imprecise probabilities and then important input portions correspond to higher-confidence probabilities]
7. Integrate with code that selects important regions of the input and feeds them to DeSTIN; this may potentially be SIFT-based as well [Amritpal, an OpenCog volunteer, is now trying this, using SIFT]

Note: the use of SIFT may seem conceptually incompatible with the design intention of DeSTIN, which is oriented toward avoiding the need for preprocessing and feature extraction. But, my suggestion is to use SIFT to emphasize and select input for DeSTIN, not to feed DeSTIN solely SIFT outputs.

DeSTIN/OpenCog integration



Basic idea:

OpenCog has a probabilistic/symbolic concept network, DeSTIN has a subsymbolic percept network in which concept representations may emerge

Clustering and supervised learning (4 and 5 above) recognize patterns in DeSTIN's state, corresponding to objects, concepts, etc.

OpenCog's inferences may be used as additional context to bias DeSTIN's probabilistic calculations

DeSTIN/OpenCog integration

8. Creation of DeSTIN/OpenCog interface that associates OpenCog ConceptNodes with combinations of DeSTIN nodes
 - Supervised learning case: e.g. link from “dog” ConceptNode to the DeSTIN pattern found to associate with perception of entities referred to as “dog”
 - Unsupervised learning case: a cluster of DeSTIN states may be used to create a new OpenCog ConceptNode, which then links to the states in the cluster
9. Utilization of activation spread into DeSTIN from OpenCog to bias perception based on conceptual knowledge *[e.g. via having this activation affect the confidence of the (imprecise) probabilities associated with more active DeSTIN nodes]*
10. Utilization of OpenCog’s knowledge to bias the probabilistic calculations inside each DeSTIN node *[e.g. use metalearning to guide the supervised learning and clustering, where the metalearner pays especial attention to prior learning problems undertaken within DeSTIN in contexts that OpenCog feels are associated with the present context]*