Detecting Irregularities in images and in video [Boiman, Irani ICCV 2005]

- The objective here is to detect "irregularities" from images and video i.e:
  1. Suspicious behaviours
  2. Salient behavior
  3. Image saliency and attention
- Inference by "synthesis": (Building a puzzle)
  - Construct new observations from chunks of data from examples in database. Large continuous chunks imply high likelihood, whereas small fragmented chunks imply low likelihood (irregular)
- Ensemble of patches:
  - Star graph configuration
  - Locations (l), descriptors (d), origins (c)
  - Descriptors based upon absolute values of derivatives of 7x7 or 7x7x4 patches
- Probabilistic graphical model formulation:
  - Summarized by the following figure from the paper

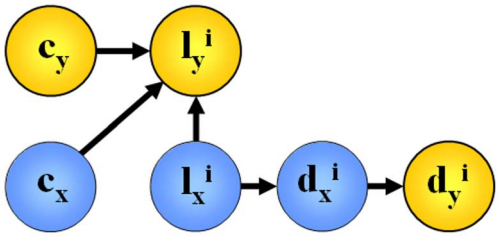

Figure 4. The probabilistic graphical model. *Observed variables are marked in "orange"; hidden database variables are marked in "blue". The directions of arrows signify Bayesian dependencies (See text for more details).*

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- Similarity between pair of ensembles is captured by the likelihood (joint probability P(x,y))
- MAP inference : message passing algorithm.
  - Message passing algorithm is made efficient with "progressive elimination" of the search space using geometric arrangement information and multi scale search is used.
- Applications:
  - Detecting unusual image configurations
  - Spatial saliency in a single image
  - Detecting suspicious behaviors
  - Spatio-temporal saliency in video