Biological Vision and Applications
Module 05-05: Context-based model

Hiranmay Ghosh

Context-based Model

A comprehensive model for top-down + bottom-up attention

- We have seen the equation earlier
  - $P(O \mid v_l, v_c) = \frac{1}{P(v_l \mid v_c)}.P(v_l \mid O, v_c).P(O \mid v_c)$
- $P(v_l \mid v_c)$:
  - Independent of object hypothesis O
  - Represents probability of the observed feature v_l in context v_c
  - It's inverse represents bottom-up saliency
    - Information-theoretic / Bayesian models ... bring in experiential factor

Top-down saliency

- We shall now contrate on the numerator:
  - $N = P(v_l \mid O, v_c).P(O \mid v_c)$
- $O = (o, x, \sigma)$ (class, location, appearance)
  - $P(O \mid v_c) = P(\sigma \mid x, o, v_c).P(x \mid o, v_c).P(o \mid v_c)$
- $N = P(v_l \mid O, v_c).P(\sigma \mid x, o, v_c).\underline{P(x \mid o, v_c).P(o \mid v_c)}$
  - $P(o \mid v_c)$: Prob of an object class to appear in a context
  - $P(x \mid o, v_c)$: Prob of an object class to appear at a certain location in a context
    - ... given that it appears
- $P(x \mid o, v_c).P(o \mid v_c) = P(o, x \mid v_c)$:
  - Represents the task-specific context-driven saliency of location

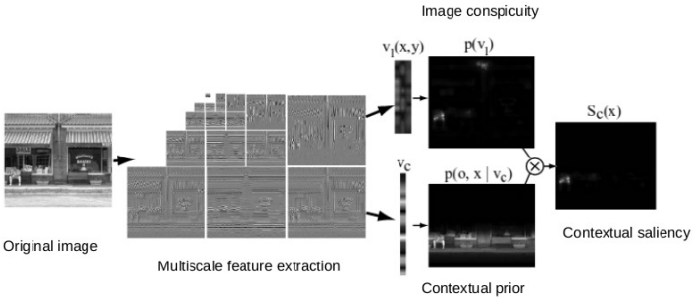
Appearance model

- We are left with the terms: $P(v_l \mid O, v_c).P(\sigma \mid x, o, v_c)$
  - $P(\sigma \mid x, o, v_c)$: Scale and appearance of the object at a certain location
    - ... given that it appears at a certain location
  - $P(v_l \mid O, v_c) = P(v_l \mid O) = P(v_l \mid o, x, \sigma)$: The expected visual features
    - ... given that the object appears at a certain location with a certain appearance

In Summary

- $P(O \mid v) = P(O \mid v_l, v_c) = \frac{1}{P(v_l \mid v_c)}.P(v_l \mid O, v_c).P(O \mid v_c)$
- Substituting (o, x, σ) for O
  - $P(O \mid v) = \underline{\frac{1}{P(v_l \mid v_c)}}. \ \underline{P(v_l \mid O, v_c).P(\sigma \mid x, o, v_c)}. \ \underline{P(x \mid o, v_c).P(o \mid v_c)}$
- Bottom-up saliency (s_b): $\frac{1}{P(v_l \mid v_c)}$
- Top-down saliency (s_t): $P(o, x \mid v_c) = P(x \mid o, v_c).P(o \mid v_c)$
- Appearance model (a): $P(\sigma \mid x, o, v_c).P(v_l \mid o, x, \sigma)$
- Overall saliency (where): $s_b \times s_t$
- Feature to look for (what): a

Local Computations



Global Computations

Quiz

Quiz 05-05

End of Module 05-05