Course notes, CS664, 9/16/04

- Formalize the problem as finding $f : \mathcal{P} \mapsto \mathcal{L}$ that minimizes
$$E_{data}(f) + \lambda \cdot E_{smooth}(f)$$

- Note what λ does. We will discuss how to solve this when we do optimization techniques (soon!)

- This kind of problem shows up constantly in vision. First term is "data" term, related to "likelihood". Second term is "smoothness", related to "prior". Sometimes called "regularization".

- Popular formalism: given $\mathcal{N}, V, D$, minimize:
$$\sum_{p \in \mathcal{P}} D(f(p)) + \lambda \sum_{(p,q) \in \mathcal{N}} V(f(p), f(q))$$

- Definitions/names of D, V, N. Depending on V this problem can actually be tractable.

- Obvious data costs: For stereo/motion, $D(f(p)) = (I(p) - I'(p + f(p)))^2$. For image restoration, $D(f(p)) = (I(p) - f(p))^2$.

- Improvement: Birchfield-Tomasi sampling

- Low-texture region propagation example: what do you do if ambiguous inside, when borders are "known"? Depends upon V!

- Everywhere smooth/Piecewise constant/Piecewise smooth V

- Define $T[\cdot]$ to be 1 if the argument is true else 0. Then $V(f(p), f(q)) = T[f(p) = f(q)]$ is piecewise constant. Called Ising/Potts model.

- Improvement: static clues.