Leveraging Context to Support Automated Food Recognition in Restaurants

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IEEE Winter Conference on Applications of Computer Vision

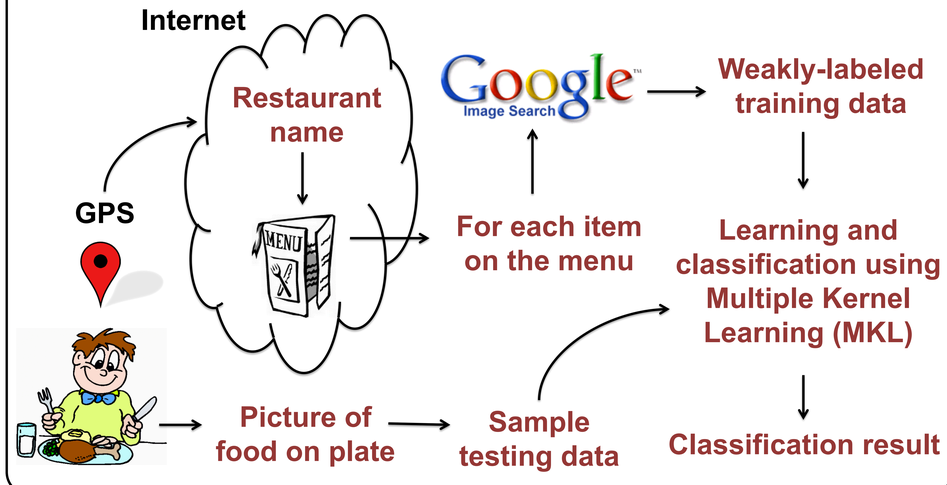
Motivation

- In **1970, 25.9%** of food spending was on food away from home
- By **2012**, this number had risen to **43.1%**
- **80%** of Americans report eating fast-food **monthly** and **40%** report **weekly**
- **Concerns:** Obesity is now a major health concern. Also challenges with nutrition and chronic diseases
- **Solution:** Tracking and logging eating habits using diaries and smartphones
- But manual tracking is **time-consuming**, **prone to errors** and susceptible to **selective under-reporting**

Features & Classifier

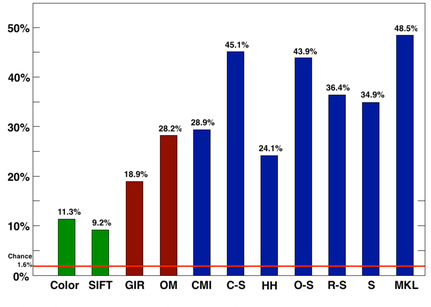
- **Harris-Laplace** point detector followed by **6 feature descriptors:**
  - **CMI:** Color Moment Invariants
  - **C-S:** C-SIFT
  - **HH:** Hue Histograms
  - **O-S:** Opponent SIFT
  - **R-S:** RGB SIFT
  - **S:** SIFT
- **Classifier:** Sequential Minimal Optimization Multiple Kernel Learning (**SMO-MKL**) SVM.

System Overview



Evaluation

- System performance tested on CMU's **PFID** food dataset
- Test images collected across **5 different cuisines** from 10 different restaurants (2 per cuisine): **American, Indian, Italian, Mexican and Thai**
- Total of **600 testing images** (300 using mobile-phone and 300 using Google Glass)
- Total of **3,750 weakly-labeled training images**



Performance of the 6 feature descriptors and SMO-MKL on the PFID dataset.

Evaluation

Weakly-labeled training images obtained from Google Image search for two classes of food. **Left:** Basil Fried Rice. **Right:** Lo Mein.

Sample (12 out of 600) "in-the-wild" images used for testing.

	CMI	C-S	HH	O-S	R-S	S	MKL
American	45.8%	51.7%	43.3%	43.3%	37.5%	29.2%	**67.5%**
Indian	44.2%	74.2%	55.0%	59.2%	69.2%	65.0%	**80.8%**
Italian	33.3%	52.5%	67.5%	**74.2%**	66.7%	49.2%	67.5%
Mexican	36.7%	35.8%	20.8%	37.5%	24.2%	33.3%	**43.3%**
Thai	27.5%	36.7%	25.0%	33.3%	**50.8%**	30.8%	**50.8%**

Classification results showing the performance of the various feature descriptors.

Confusion Matrices