Dog Breed Classification Using Part Localization

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Problem and Contributions

- Fine grained categorization of dog breeds
- Create a new dataset covering 133 dog breeds
- Apply part detection to object classification
- Infer class-specific object parts to improve classification
- Design a free iPhone app for dog breed identification

Dog Breed Dataset

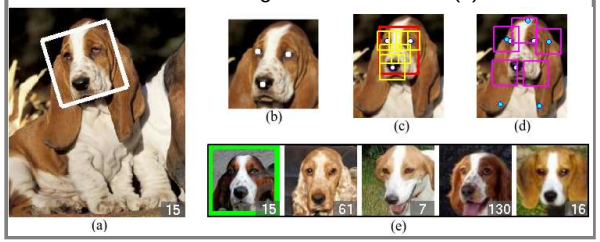
- 133 American Kennel Club (AKC) recognized dog breeds
- 8,351 real-world images of dogs
- 66,808 part labels (Eight per image)

Example Breeds

Example Part Labels

Pipeline

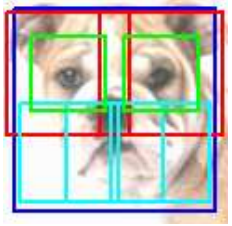
- Face detection (a) and Fiducial localization (b)
- Feature extraction at detected and inferred fiducials (c, d)
- Breed classification using the facial features (e)



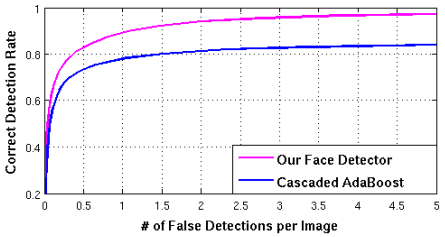
Dog Face Detection

- Our classification algorithm focuses on the face of the dog
- The face is largely rigid, and contains much of the identity information
- The face detector is a SVM regressor with greyscale SIFT as features
- The SIFT descriptors are extracted at fixed positions and scales
- The sliding window detector scans the image over scale and rotation

Feature Windows



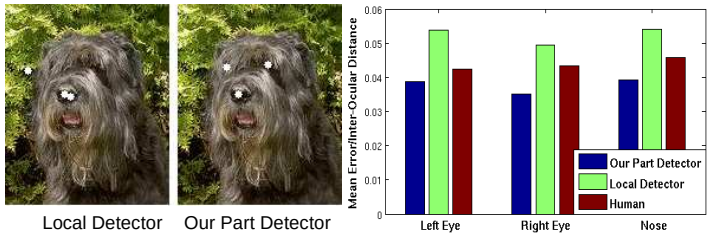
ROC Curve for Face Detection



Face Part Localization

- Build on the consensus of models approach for the generic parts
- Combine low-level detectors with shape model of part locations
- The local detector is a sliding window SVM with SIFT over scales

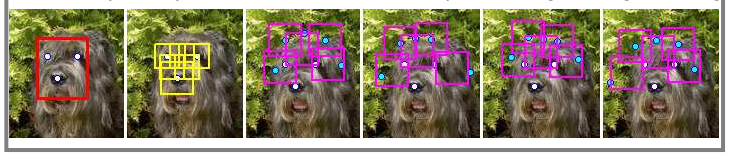
Localization Results



Local Detector Our Part Detector

Breed Classification

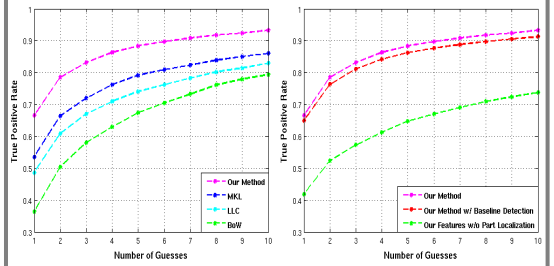
- Train one vs. all SVMs for each breed
- Two types of features: greyscale SIFT and color histogram
- SIFT features are extracted at places dictated by the part locations
- Breed-specific parts are inferred from exemplars during training & testing



Classification Examples

Query Top Guesses

ROC Curve for Breed Classification



Our method achieves 67% classification rate, demonstrating the importance of part correspondence. Also, part detection assists in improving face detection, thus benefitting the whole system.

iPhone App: DogSnap

Home Screen Browse Dog Camera Results