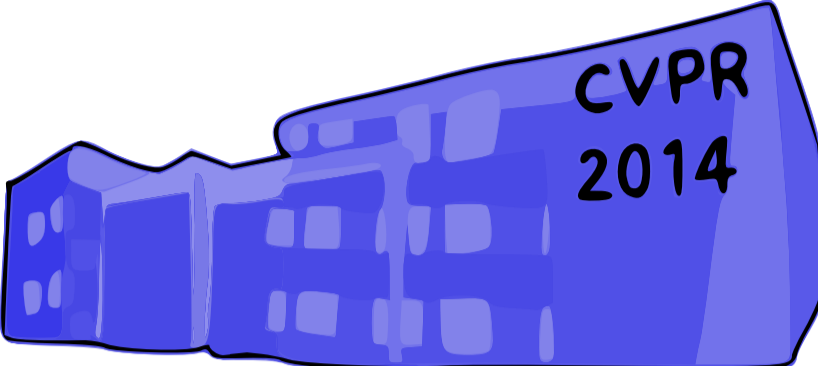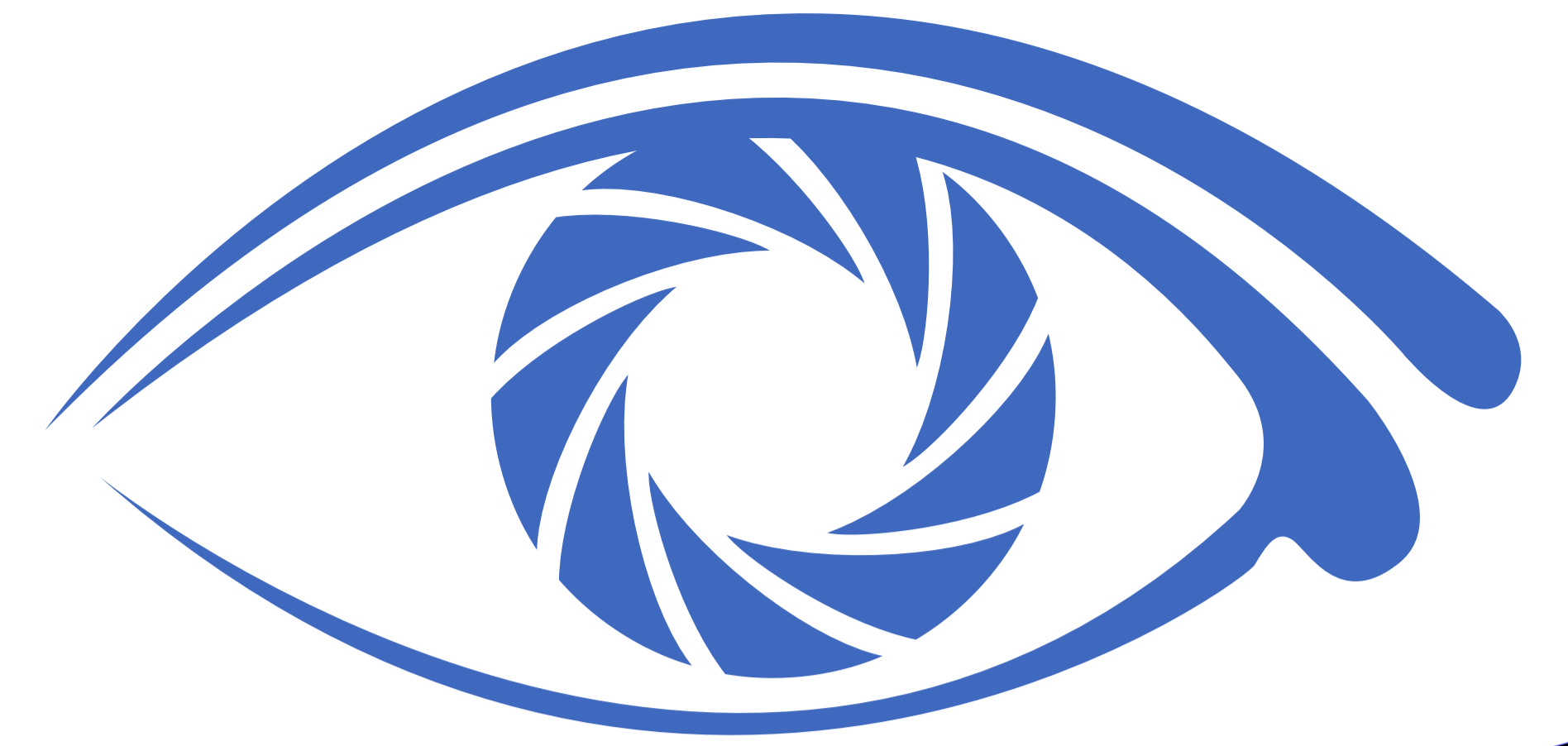# Nonparametric Part Transfer for Fine-grained Recognition

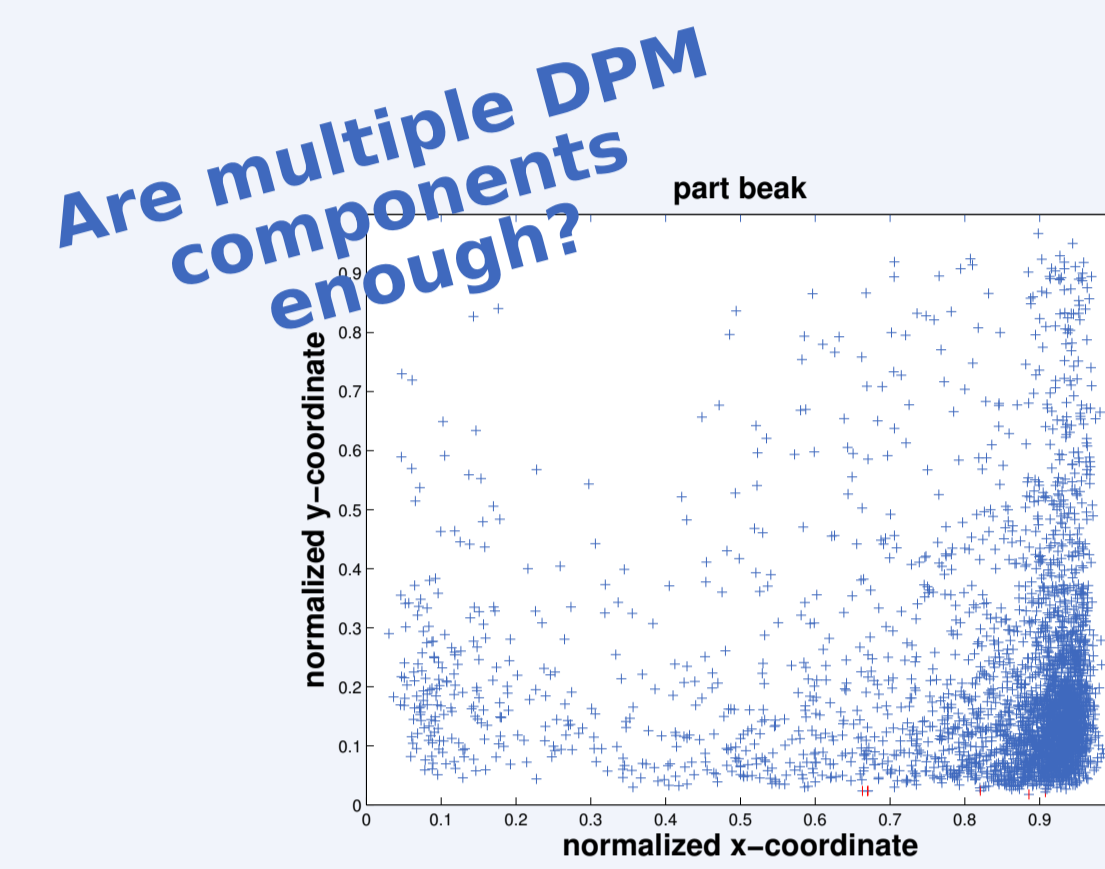**Christoph Göring, Erik Rodner, Alexander Freytag, and Joachim Denzler**

Computer Vision Group, Friedrich Schiller University Jena, Germany

`http://www.inf-cv.uni-jena.de`

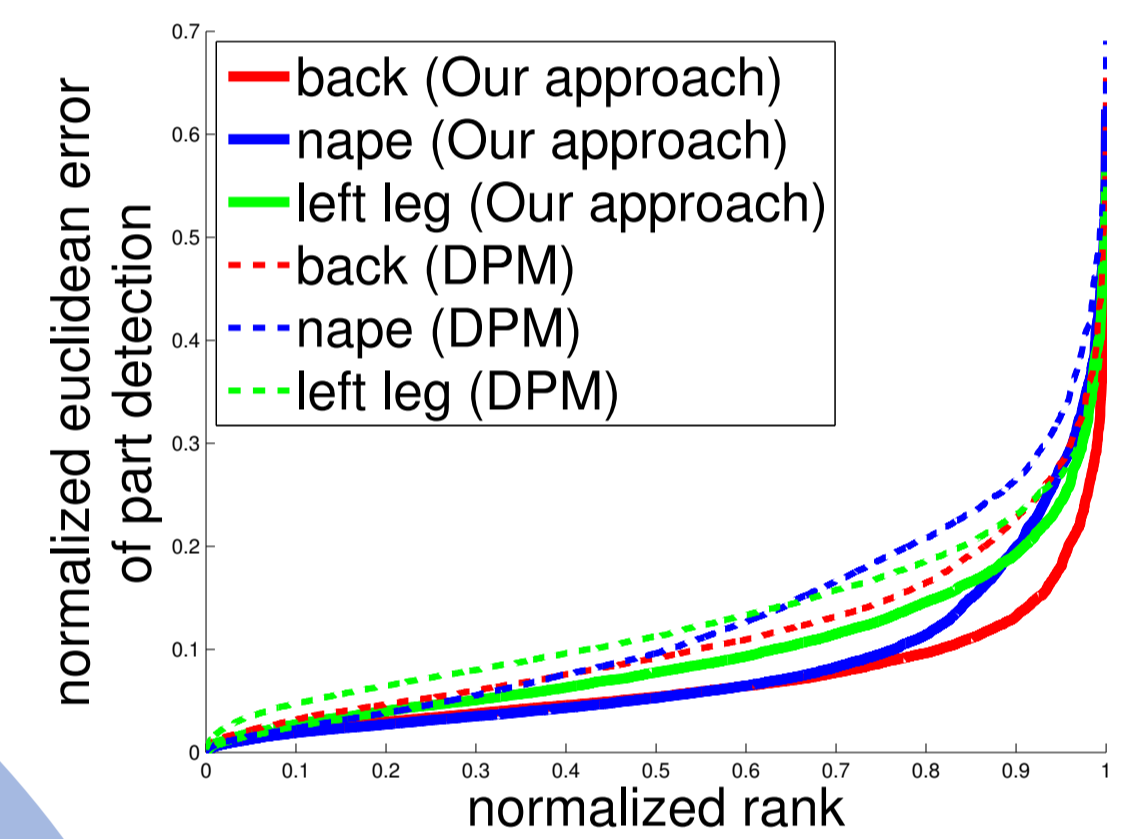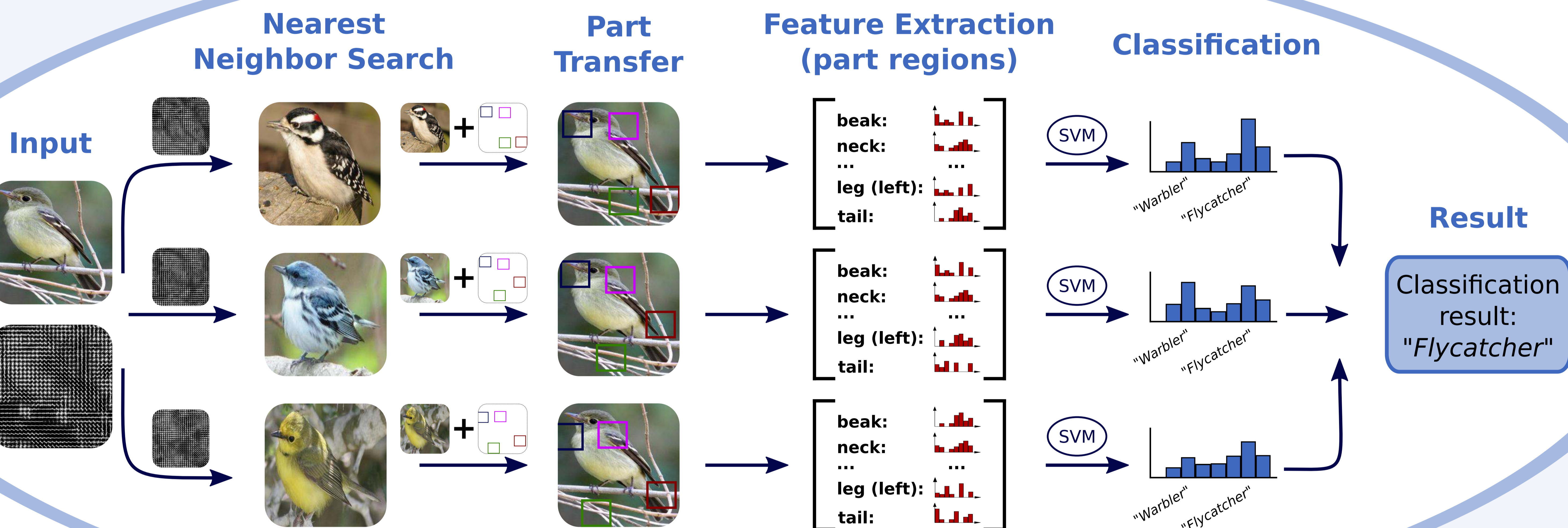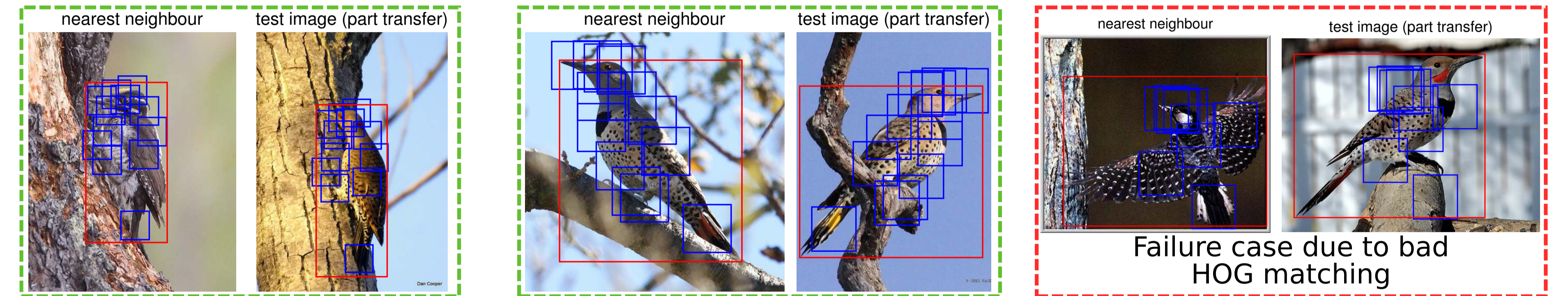since 1558

Code Available

CVPR 2014

Motivation and method

- Fine-grained recognition: part-based approaches necessary but part locations are difficult to estimate

- **Our approach:** efficient non-parametric detection with part transfer

- Algorithm to classify a test image

  1. Find k nearest neighbours in the training set using HOG to get similar poses
  2. Transfer part locations from each of the neighbours (rescaling)
  3. Compute k feature representations by using the k part constellations
  4. Combine k classifier decisions by averaging

Are multiple DPM components enough?

part beak

normalized y–coordinate

normalized x–coordinate

Nearest Neighbor Search

Part Transfer

Feature Extraction (part regions)

Classification

Input

SVM

beak:
neck:
...
leg (left):
tail:

"Warbler"   "Flycatcher"

Result

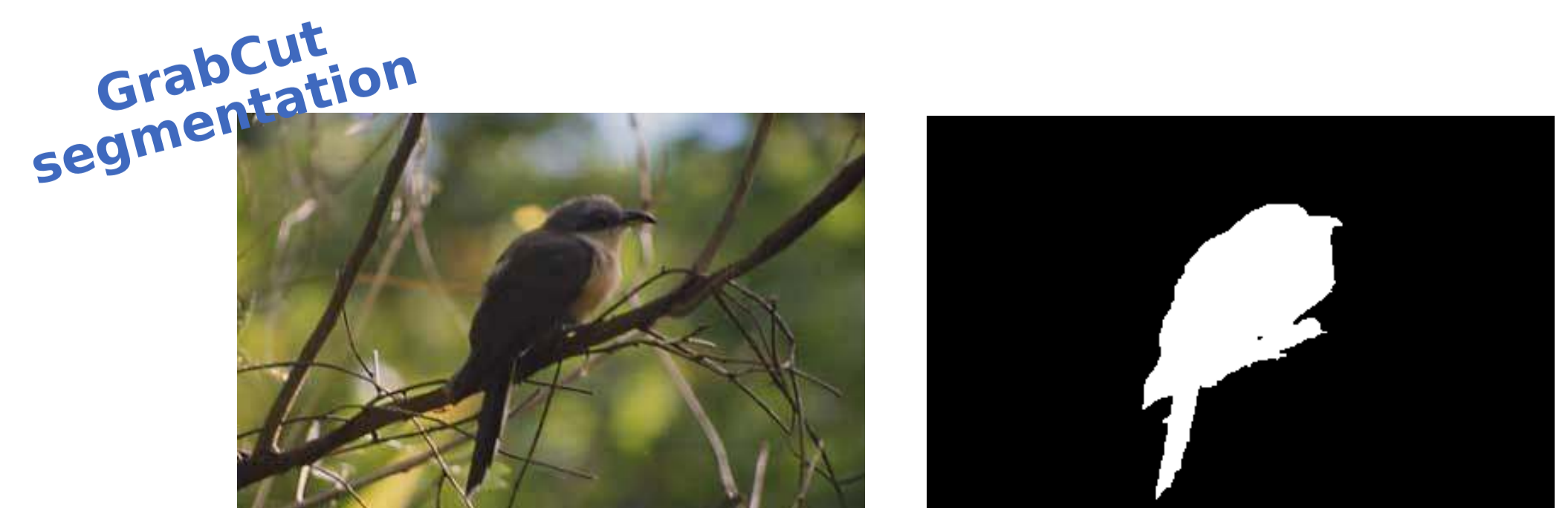Classification result: "*Flycatcher*"

Simple - but effective!

colorname descriptor

- GrabCut segmentation for masking

- Combination of SIFT and color descriptors (van de Weijer)

- Part-specific bag-of-words codebooks

- Linear SVM for classification with explicit kernel transforms

- Taking care of part constellation symmetry

GrabCut segmentation

Method	CUB-2011/14
NN part transfer	69.85%
…without GrabCut masking only	68.09%
…without part features only	66.08%
…without global features only	61.56%

Implementation details

Part detection performance

nearest neighbour   test image (part transfer)

nearest neighbour   test image (part transfer)

nearest neighbour   test image (part transfer)

Failure case due to bad HOG matching

normalized euclidean error of part detection

normalized rank

- back (Our approach)
- nape (Our approach)
- left leg (Our approach)
- back (DPM)
- nape (DPM)
- left leg (DPM)

Approach	CUB-2010
Template (Yang, NIPS 2012)	28.20%
Segmentation (Angelova, CVPR 2013)	30.20%
Bubblebank (Deng, CVPR 2013)	32.50%
DPD (Zhang, ICCV 2013)	34.50%
Ours, part transfer	**35.94%**

Approach	CUB-2011/14	CUB-2011/200
PDL (Jia, arXiV 2013)	-	38.91%
Template (Yang, NIPS 2012)	-	43.67%
DPD (Zhang, ICCV 2013)	-	50.98%
POOF (Berg, CVPR 2013)	70.10%	56.78%
Ours, DPM	67.59%	39.18%
Ours, part transfer	69.85%	54.76%
Ours, part transfer ensemble with $k = 5$	**73.86%**	**57.84%**

Classification performance