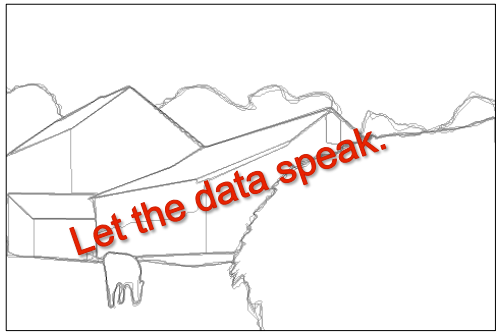
Structured Forests for Fast Edge Detection

Piotr Dollár and Larry Zitnick

Microsoft Research

what defines an edge?

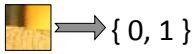


Brightness
Color
Texture
Parallelism
Continuity
Symmetry
…

1. Accuracy
2. Speed

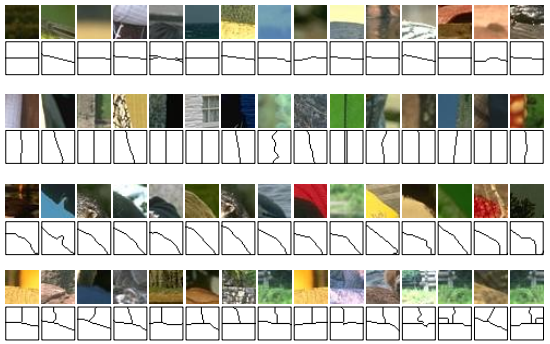
I. data driven edge detection

edge detection as classification

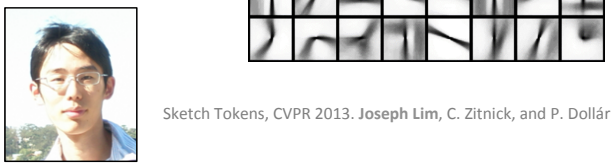


Supervised Learning of Edges and Object Boundaries
CVPR 2006, Piotr Dollár, Zhuowen Tu, Serge Belongie

edge have *structure*

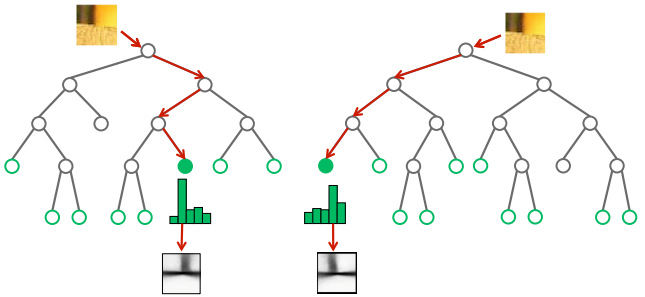


sketch tokens

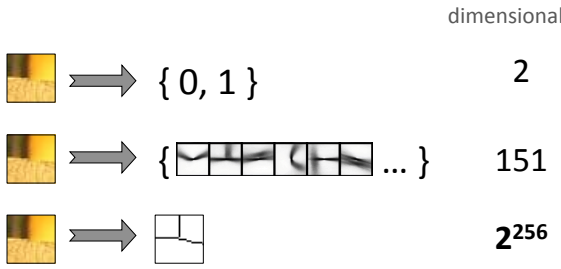


Sketch Tokens, CVPR 2013. **Joseph Lim**, C. Zitnick, and P. Dollár

random forests

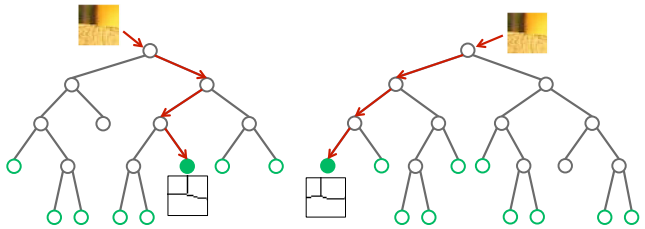


upgrading the output space



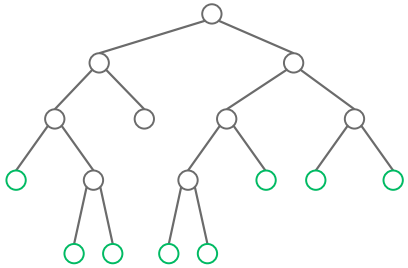
II. structured edge learning

structured forests

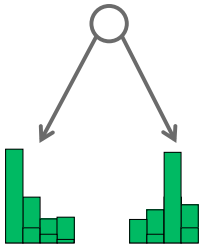


Structured Class-Labels in Random Forests for Semantic Image Labelling, ICCV 2011, P. Kontschieder, S. Rota Bulò, H. Bischof, M. Pelillo

tree training

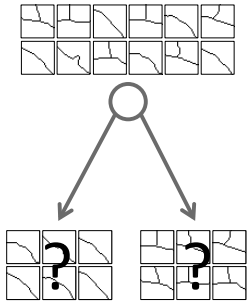


node training



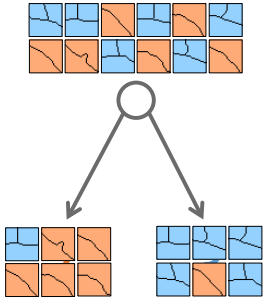
low entropy split ☺

how to train?



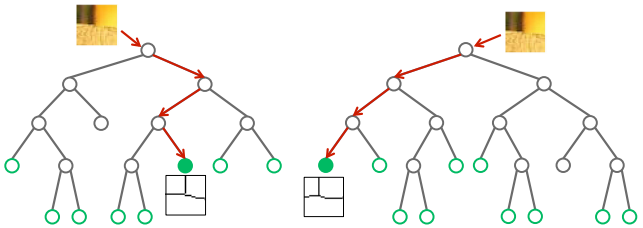
bad split ☹

minimize entropy

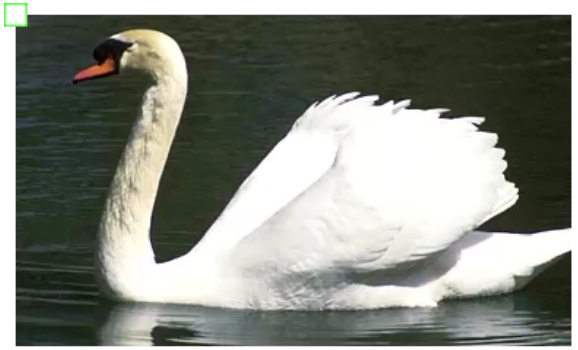


III. structured edge detection

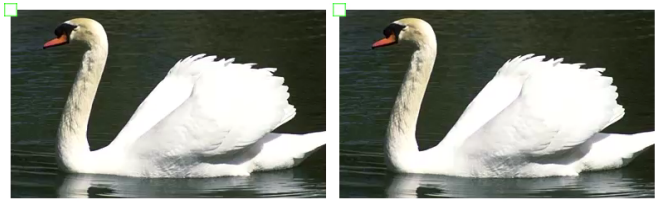
structured forests



sliding window detector



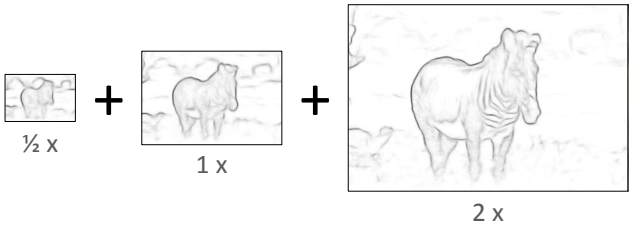
sliding window detector



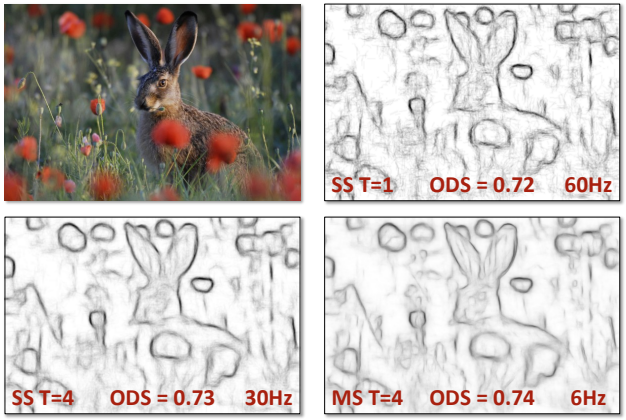
pixel output ☹ structured output ☺

multiscale detection

multiscale detection

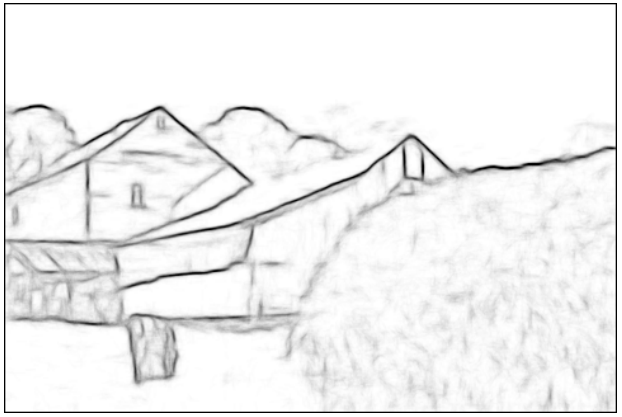


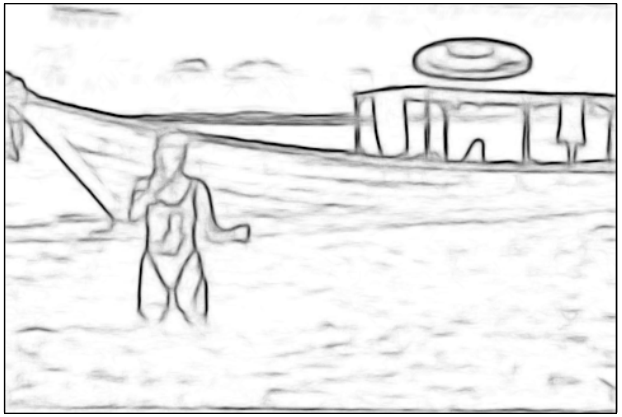
IV. results

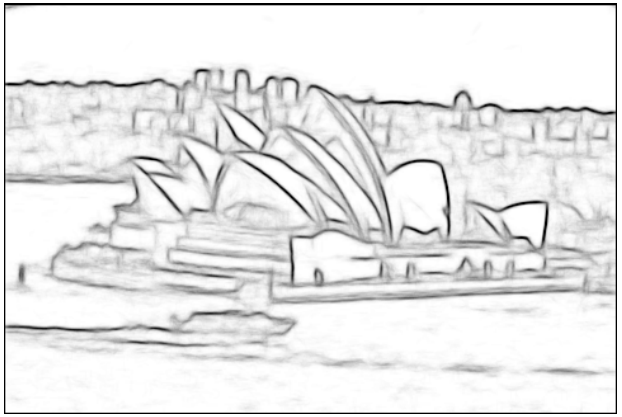


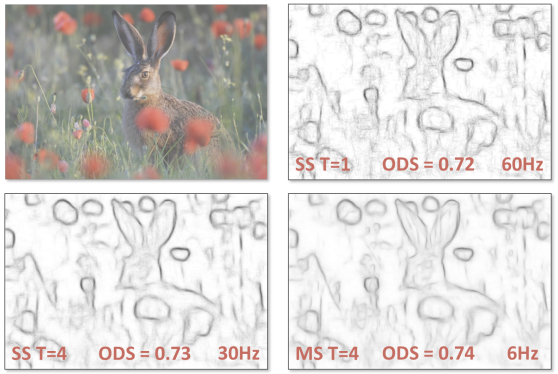
gPb ODS=.73 FPS ≈ 1/240 Hz

	ODS	OIS	AP	FPS
Human	.80	.80	-	-
Canny	.60	.64	.58	15
Felz-Hutt [11]	.61	.64	.56	10
Hidayat-Green [16]	.62†	-	-	20
BEL [9]	.66†	-	-	1/10
gPb + GPU [6]	.70†	-	-	1/2‡
gPb [1]	.71	.74	.65	1/240
gPb-owt-ucm [1]	.73	**.76**	.73	1/240
Sketch tokens [21]	.73	.75	**.78**	1
SCG [31]	**.74**	**.76**	.77	1/280
SE-SS, T=1	.72	.74	.77	**60**
SE-SS, T=4	.73	.75	.77	30
SE-MS, T=4	**.74**	**.76**	**.78**	6









thanks! source code available online