What can I do with IKB?

Object identification, Surface classification and anomaly detection, Template matching, Image mapping

Knowledge Builder Workflow



(c) General Vision Inc. 1/17/2019

IKB main panel



Practice with IKB

Try the example projects installed with the software...

BGA Inspection

Learn 10 examples, Count all 356 solder balls

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	Learn Mode Categories			Output Mode	
Leam	Annotations v 10 ball v		Reco	Clusters V 356 V Box	¢
Auto	StepXY 1 1	Scale	Auto	StepXY 1 🛊 1 荣 🗹 SkipX	SkipY
		1.00 🜩			
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Face recognition

8 models recognizing 4 soccer teams, and also faces from the ferret data base



Kanji Recognition

- Knowledge of 360 kanji characters
- >68K local recognition of a block of 16x16 pixels
- Equivalent to 12 gops on ½ watt chip



Glass surface inspection

- Learn patches of good texture
 - > The content of the neurons is called a codebook
- Report location of unknown patches, or defects



Wafer inspection

- Load a reference image to the neurons
 - per block of 16x16 pixels or else
 - neuron K holds the pixels of the Kth raster block
- Report location of unknown blocks in new images



Introduction to Image Compression

- Build a codebook of reference patches of 9x9 pixels using the generalization capabilities of the neurons
- Transform a new image replacing its 9x9 patches by their closest matches
- Ability to fine tune with a smaller Maxif prior to building the codebook.
- Options: smaller patches, color feature



RoadTrip

- 2 annotations, 2 neurons
- Recognition of the border and center lane



Overview

Menus and Tools

IKB main panel



Learning modes

- Supervised
 - From user annotations
 - Partial annotations of patches of pixels with user-defined categories
 - Options:
 - Automatic background examples
 - Adjacent background examples
 - From Ground Truth image (IKB Pro only)
 - 100% pixel annotation through an 8-bit indexed image

Unsupervised

- Codebook
 - Use the neurons to learn the "significant" codes
 - Tuning of the Maximum Influence Field (MAXIF) and learning step
 - Number of neurons is function of the MAXIF
- Golden template (IKB_TemplateMatching only)
 - Learn all the codes of the reference image (one neuron per code)
- Saliency (IKB Pro only)
 - Isolate the most salient codes

Recognition modes

- Report lists
 - Recognized objects
 - Clusters of recognized objects
 - Anomalies or non recognized objects

Maps or Transform images

- Distribution of the objects per category or distances
- Transform in which each block is replaced by its closest model
- Options
 - Scanning Step X and Y







Supervised Learning

-Object size and significant feature -Category names and labels -Other options Defining your project...

- Select categories and associated colors for highlights in the main panel
- Select nominal size of the object or patch of pixels to work with
- Select feature extraction
- Change default network settings with caution

Exper	rt Settings			- 🗆 X		
User	categories	Reset	Expert Description			
	Name	Color	ROI Width 16 🖨			
•	Background		ROI Height 16 🚔			
	Object					
•			Subsample 🗸	Block Width		
			Normalize	Block Height 1 👤		
			Influence Field Range	Suggest		
			Max 8000 🖨	Suggesi		
			Min 2 📥	Validate		

Which relevant ROI size...

- Find the minimum matrix of discrimination
 - Smallest region including discriminant information
- The bigger the region
 - The more compression to fit in a 256-byte feature vector
- The smaller the region
 - The less variation to change of scale



ROI selection

Good



- Not impacted by the color/shades of the background
- Not impacted by type of haircut, presence of a beard or earrings

Too large



- Teach the neurons to recognize a face in front of a white background. Recognition will fail in front of a painting
- Impacted by haircut, presence of earrings, beard, etc.

Feature Selection

SubSample (average of pixel blocks)



Histogram (cumulative)





Horizontal profile (average of lines)





Learn User Annotation



Annotations management

Automatic management





Manual management

- Clear
- Load
- Save
- Format
 - Header
 - List of category names
 - 1 entry per annotation
 - [imageName, [L,T,W,H], category]

Unsupervised Learning

Code size-Network generalization level-Other options-

Unsupervised learning of a Codebook

Source image



Unsupervised learning of a golden template

160 x 94 n2 n3 n1 n5 n6 n7 n8 n4 Step=Block n10 n11 n12 n13 n14 n15 ROI = 16x16... Step= ½ Block n1 n2 n3 n4 n5 n6 n7 n8 Reco: Broadcast an ROI. The ... identifier of the firing n21 n22 n23 n24 n25 n20 neuron can be converted to an XY position in the image

Learn: Load all ROIs into the neurons

Detection of salient blocks (IKB Pro)

- Learn all the blocks of 16x16 pixels
- Locate blocks stored in neurons with highest AIF

Tools

-Navigation -Object size and significant feature -Category names and labels -Knowledge review

Navigation and Status Bars

Right Click = single annotation, Left Move = paint annotations, Shift Click or Move = delete

Project: bga.csp Neurons: 0 BGA.png, scaled 1/1: 459x381x3 Maxif: 1500, featureID: 0, normalize: 0, size: 12x12, block: 1x1, step reco: 1, 1, skip: 1, 0 \ 10 Annotations

Review the knowledge

- Review the consistency of the knowledge
 - Possibly reveal errors in GT image or user annotations
- Understand how a codebook is built
- Two display options:

	NeuronID	Category	Model	Active IF	Degenerated	
ŀ	1	cloud		2686		
	2	grapes		12268		Ε
	3	soil	20	6649		
	4	soil	σ	6948		
	5	soil	1	8322		
	6	sky		8936		
	7	soil	23	8993		
	8	soil	5	7395		-

Local observation

- Move cursor over the source image and review the top 2 firing neurons, if applicable
- Understand if uncertain classifications should be corrected or not