

Grim Grins

Project Number 5.

Grim Grins: The Team.

Team members:



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Grim Grins: Original Problem.

- Smiling faces.
- Input: a set of photos of the same person with different face expressions.
- Task: to write a program recognising the smiling faces of the same person.
- Output: smiling or not, and the statistics of the implemented method.

Grim Grins: The Problem.

- Project description:**
 - Find the emotions on test images.
- Emotions to be found:**



Happyness



Anger



Fear



Surprise



Sadness

Grim Grins: Tasks assignment.

How we divided the tasks between ourselves ?



- Neural network
- Research activities
- Matlab programming



- Photograph database preparation
- HTML presentation



- Algorithm development
- Matlab programming
- Research activities



- Matlab programming
- Research activities
- Powerpoint presentation

Grim Grins: Preprocessing.

- All images has to be taken at same light conditions.
- We found very few images where emotions are shown, so we created our own database of the SSIP participants (most test images are used for face recognition).

Grim Grins: Development tools.

- **Matlab:**
 - Image Processing Toolbox.
 - Neural Network Toolbox.

Grim Grins: Feature detection.

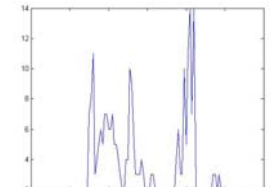
- Image size: 112 x 92 pixels.



Original image



Edge image



Horizontal projection of edge image

Grim Grins: Feature detection.

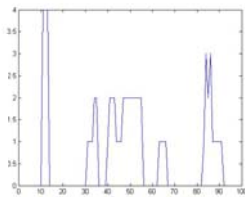
- Image size: 15 x 92



Mouth cropped from original image



Corresponding edge image



Vertical projection of mouth

Grim Grins: Simple algorithm.

- **Analysis of the mouth.**



Max (abs (bottom_value)) > Max (abs (top_value)) → **Happy**

Grim Grins: Simple algorithm.

- **Analvsis of the mouth.**



Max (abs (bottom_value)) < Max (abs (top_value)) → **Sad**

abs (Max (abs (bottom_value)) - Max (abs (top_value))) < 2 → **Normal**

Grim Grins: Neural Network.

- Backpropagation training function (gradient descent momentum)
- Input layer (403 inputs)
- 1 hidden layer (202 nodes)
- Output layer (3 outputs)

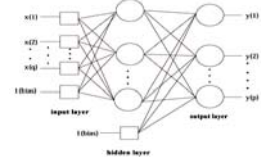


Figure 1: Structure of a feedforward neural network.

Extracted mouth:
13 * 31 = 403 pixels

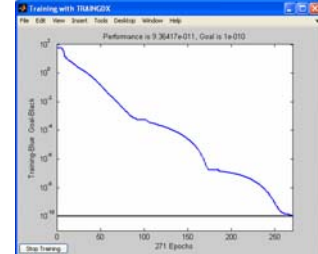


Grins: Neural Network.

- **Hidden layer activation function (tangent sigmoid transfer function)**
 - TANSIG(N) calculates its output according to: $n = 2/(1+\exp(-2*n))-1$
- **Output layer activation function (linear transfer function)**
 - $\text{purelin}(n) = n$
- **MSE error rate:**
 - $10^{(-6)}$.

Grins: Neural Network.

- Iteration chosen 750, but neural reached at 271. epoch:
- Epochs = 750
- Show = 5
- Goal = $1e-10$
- Lr = 0.1



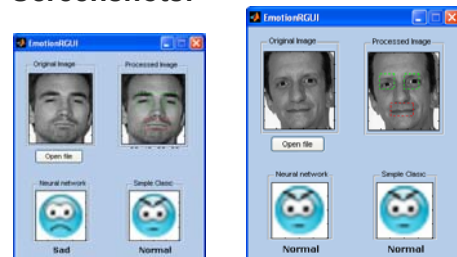
Grim Grins: Neural Network.

- **Output matrix (3 possibilities):**

$\begin{bmatrix} 1 \\ -1 \\ -1 \end{bmatrix}$	$\begin{bmatrix} -1 \\ 1 \\ -1 \end{bmatrix}$	$\begin{bmatrix} -1 \\ -1 \\ 1 \end{bmatrix}$
Happy	Normal	Sad

Grim Grins: Software.

- **Screenshots:**



Grim Grins: Statistics.

- 15 x 3 used images.
- Simple algorithm:
 - 70% recognised emotions.
- Neural Network algorithm:
 - 80% recognised emotions.

Grim Grins: Future.

- Add the eyes and eyebrow features.
- Detect more face features.
- Use Kalman filtering algorithm for improving the quality of the processed images.

[Grim Grins: Questions.]

Thank you for your attention.

Questions?