
VC 10/11

Course Projects

Mestrado em Ciência de Computadores
Mestrado Integrado em Engenharia de Redes e
Sistemas Informáticos

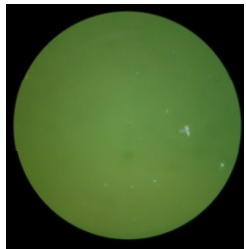
Miguel Tavares Coimbra

Projects

- **Proposed projects**
 - Residual water quality analysis
 - Vitiligo segmentation
 - Coal macerals quantification
- **Popular projects**
 - Face detection
 - Pedestrian / Vehicle detection

Project 1: Residual water quality analysis

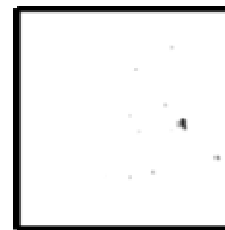
Images using
DAPI y FISH



Spatial K-Means



Selecting bacteria alive



Bacteria Identification

Area > 60 pixels
Pixels > 60% area



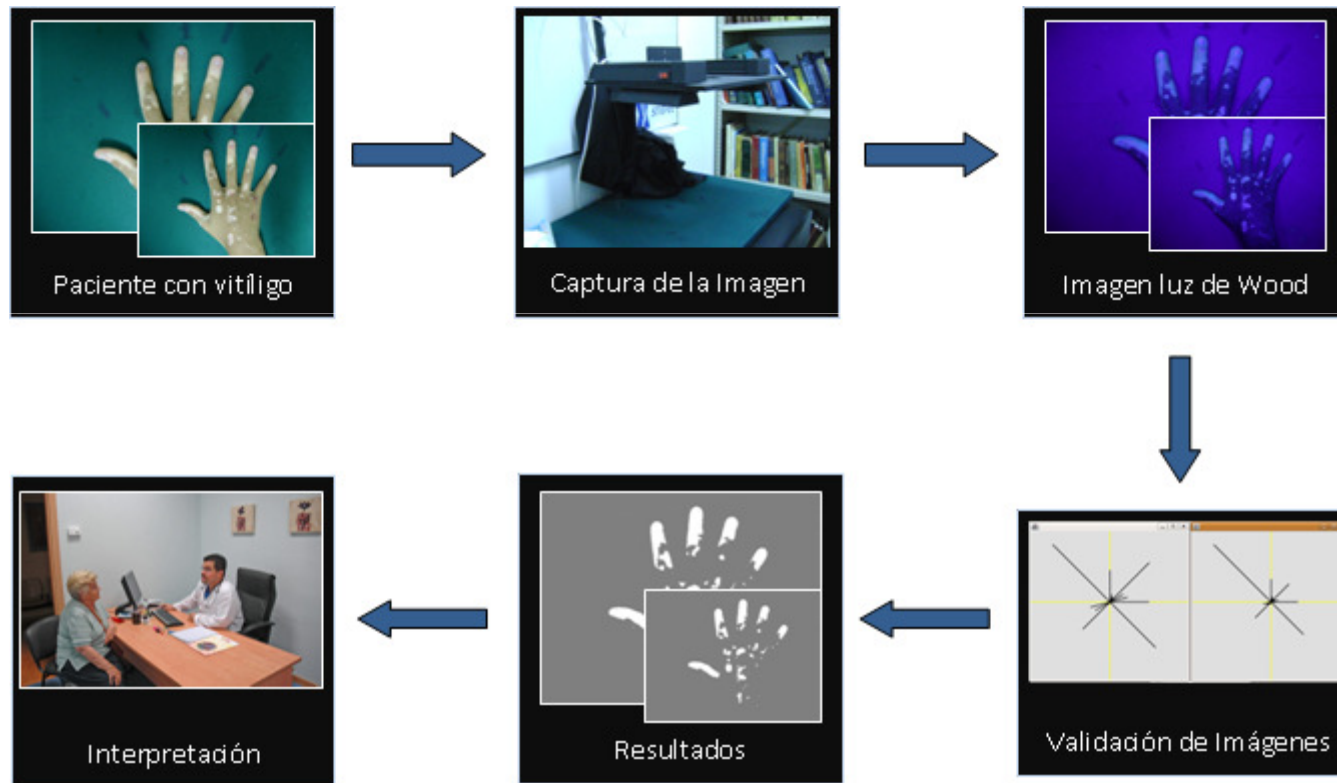
Residual water quality analysis

- **Objective**
 - Count the number of a specific type of live bacteria in a water sample microscopy image
- **Motivation**
 - Evaluation of new biological techniques for cleaning residual water
 - Manually it took 800 hours for 20000 x 2 images
 - Over time (2 years)
 - Different locations
 - Two biological approaches
- **Institutions**
 - Universidad del Valle
 - Local government

Challenges

- Segmenting bacteria in two different images
 - One with just one type of bacteria
 - Other with all live bacteria
- Classify and count live bacteria of a single type
- Compare to manual counting results

Project 2: Vitiligo Segmentation



Vitiligo Segmentation

- **Objective**

- Quantify the hand skin area affected by Vitiligo

- **Motivation**

- Monitor the evolution of Vitiligo's disease in a patient.

- **Institutions**

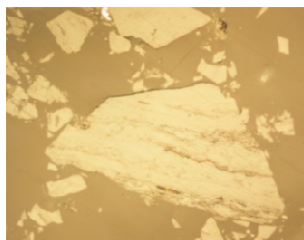
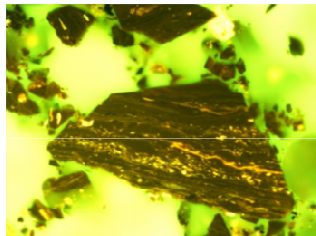
- Universidad del Valle, Colombia
- Hospital Evaristo Garcia, Colombia

Challenges

- Identify all hand pixels affected by Vitiligo
 - Using Wood light
 - Using normal light
- Quantify Vitiligo areas in the whole hand and in each individual finger
- Provide a comparison measure between two sessions

Project 3: Coal Macerals Quantification

Imágenes de microscopia
en luz azul y luz blanca



Imágenes segmentadas
con K-Means

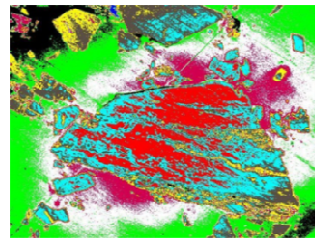
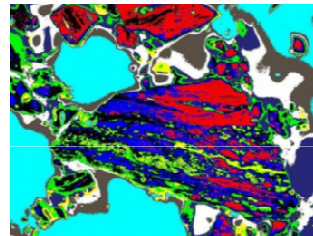
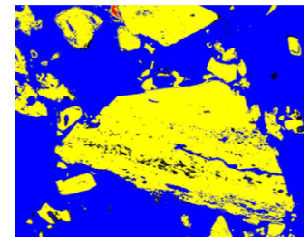


Imagen con grupos
macérales:

Color	Maceral	Porcentaje
Amarillo	Vitrinita	90.3829%
Rojo	Liptinita	1.63374%
Negro	Inertinita	7.98338%



Resultados de cuantificación
de una muestra de carbón

Imagen Original	Imagen Segmentada	Porcentaje	Resultado Final
01	01	90.3829%	Vitrinita
02	02	1.63374%	Liptinita
03	03	7.98338%	Inertinita

Coal Macerals Quantification

- **Objective**

- Quantify the amounts of each maceral groups in images of samples of coal.

- **Motivation**

- Identify the best use for the coal of a specific mine given its chemical composition

- **Institutions**

- Universidad del Valle, Colombia

Challenges

- Two images
 - One with blue light
 - One with white light

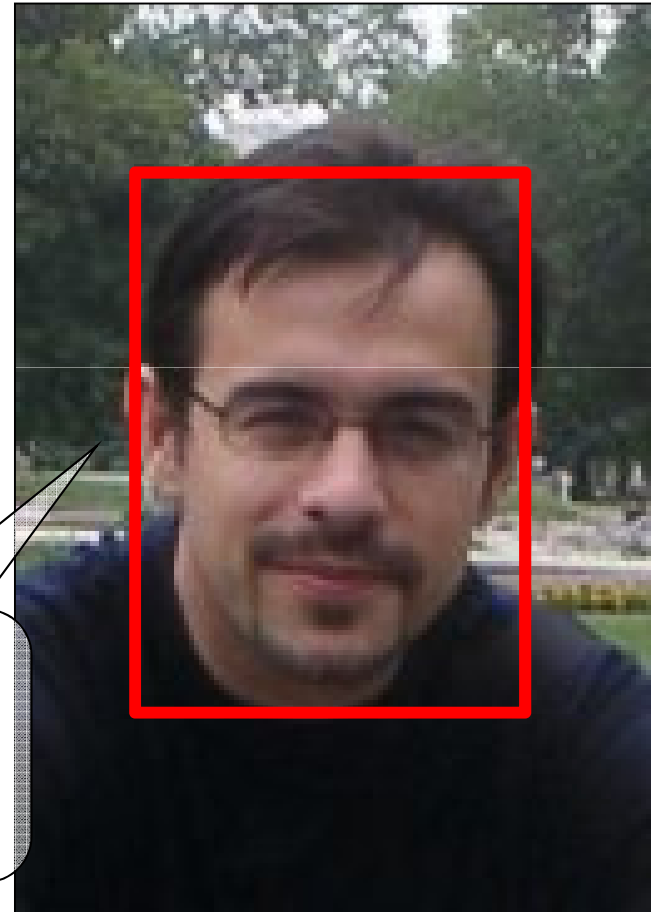
Project 4: Face Detection

- **Objectivo**

- Identify that there is a human face in a picture

- **Motivation**

- Facial recognition
- Biometrics
- Improved Auto-focus



Popular research topic

- PCA
- ICA
- LDA
- EP
- EBGM
- Kernel Methods
- Trace Transform
- AAM
- 3-D Morphable Model
- 3-D Face Recognition
- Bayesian Framework
- SVM
- HMM
- Boosting & Ensemble

• <http://www.face-rec.org/algorithms/>

M. Turk, A. Pentland,
Eigenfaces for Recognition,
Journal of Cognitive
Neuroscience, Vol. 3, No. 1,
1991, pp. 71-86

Popular topic but this
is **The Paper**

<http://www.cs.ucsb.edu/~mturk/Papers/jcn.pdf>

Support material

- http://en.wikipedia.org/wiki/Facial_recognition_system
- <http://www.myheritage.com/FP/Company/tryFaceRecognition.php>

Project 5: Pedestrian / Vehicle Detection

- **Objective**
 - Detect and track object motion on images captured by static cameras
- **Motivation**
 - Video surveillance
 - Intrusion alarms
 - Crowd monitoring





Eric Harris and
Dylan Klebold, in
the Columbine High
School Massacre
via CCTV cameras

L. 11:57:20-63 AM 04/20/99



The men alleged to be responsible for the 7 July attacks on London, captured on CCTV.

Typical approach

- **Assume camera does not move**
 - Static background. I can “learn” it
- **Background modeling**
 - Picture with an empty scene
 - Statistical methods
- **Background subtraction**
 - Everything different from the background must be a person / vehicle
 - Process shapes of resulting objects



<http://www.merl.com/projects/pedestrian/>

Support material

- Background subtraction for the detection of moving objects:
 - <http://www.llnl.gov/casc/sapphire/background/background.html>
- Review on popular algorithms:
 - <http://www.mcs.csu Hayward.edu/~tebo/Classes/6825/ivcnz00.pdf>
 - <http://www-staff.it.uts.edu.au/~massimo/BackgroundSubtractionReview-Piccardi.pdf>

Projects

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 - Residual water quality analysis
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 - Pedestrian / Vehicle detection
- **Your proposals!**