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# CV 10/11

## Course Projects

MAP-i Doctoral Program

***Miguel Tavares Coimbra***

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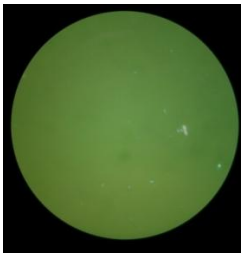
# Projects

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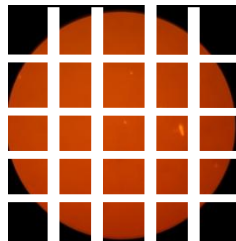
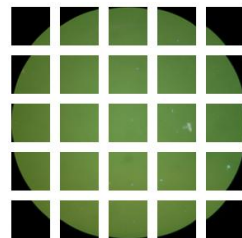
- **Proposed projects**
  - Residual water quality analysis
  - Vitiligo segmentation
  - Coal macerals quantification
- **Popular projects**
  - Face detection
  - Pedestrian / Vehicle detection

# Project 1: Residual water quality analysis

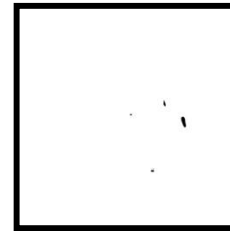
Images using  
DAPI y FISH



Spatial K-Means



Selecting bacteria alive



Bacteria Identification

Area > 60 pixels  
Pixels > 60% area



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# Residual water quality analysis

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- **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

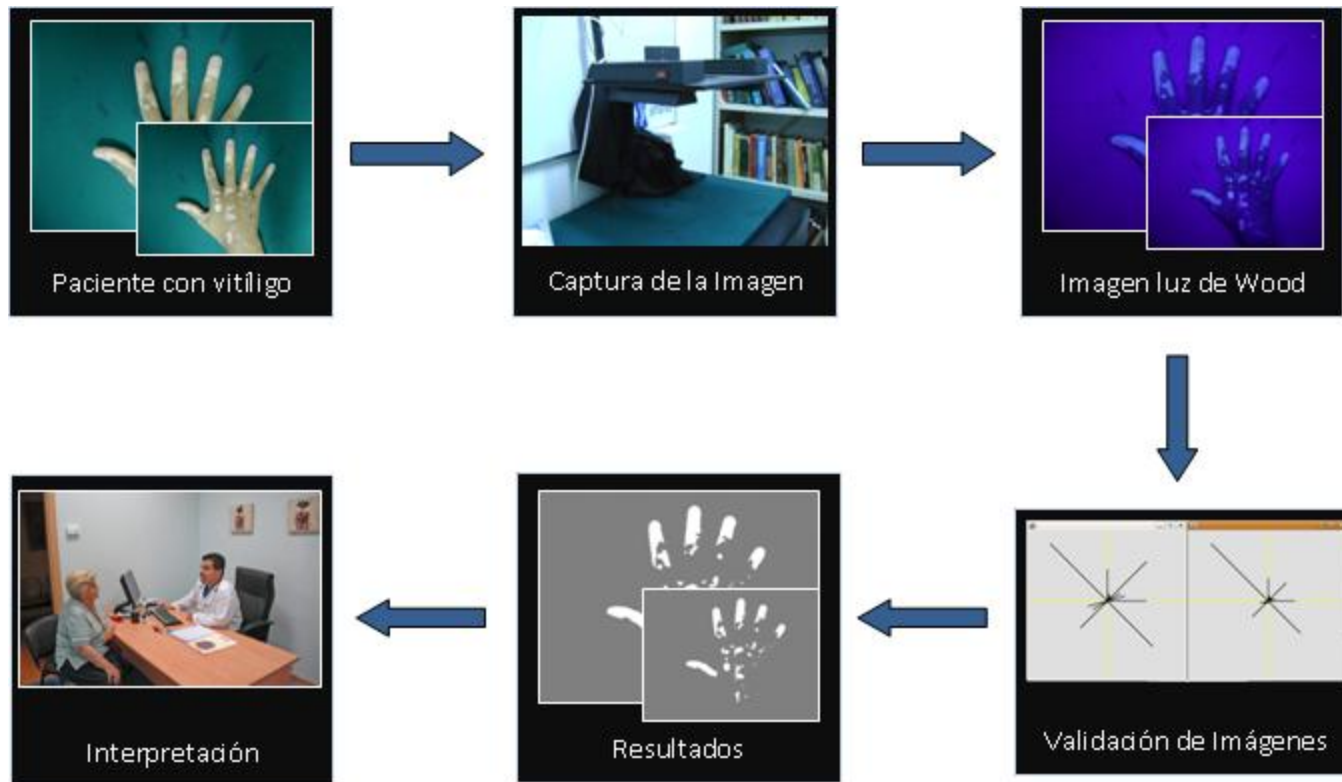
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# Challenges

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- 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



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# Vitiligo Segmentation

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- **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

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# Challenges

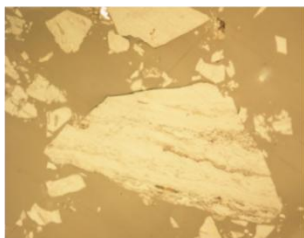
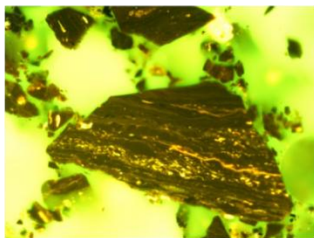
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- Identify all hand pixels affected by Vitiligo
  - Using Wood light
  - Using normal light
- Quantify Vitiligo areas in the whole hand and in each individual finger
- Provide a comparison measure between two sessions



# Project 3: Coal Macerals Quantification

Imágenes de microscopia en luz azul y luz blanca



Imágenes segmentadas con K-Means

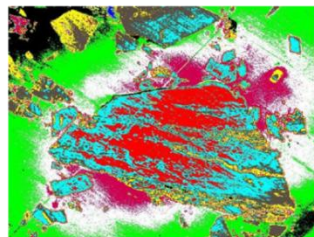
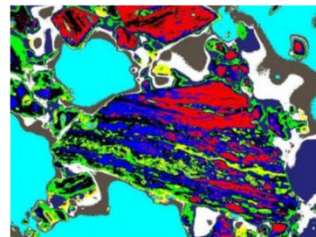
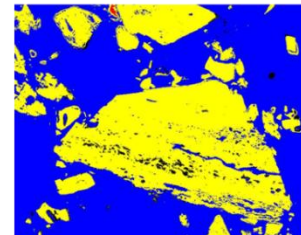


Imagen con grupos macerales:

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



Resultados de cuantificación de una muestra de carbón

Proceso	Carbón	Vitrinita	Liptinita	Inertinita	Total
1	100.0000	90.3829	1.63374	7.98338	100.0000
2	100.0000	90.3829	1.63374	7.98338	100.0000
3	100.0000	90.3829	1.63374	7.98338	100.0000
4	100.0000	90.3829	1.63374	7.98338	100.0000
5	100.0000	90.3829	1.63374	7.98338	100.0000
6	100.0000	90.3829	1.63374	7.98338	100.0000
7	100.0000	90.3829	1.63374	7.98338	100.0000
8	100.0000	90.3829	1.63374	7.98338	100.0000
9	100.0000	90.3829	1.63374	7.98338	100.0000
10	100.0000	90.3829	1.63374	7.98338	100.0000
11	100.0000	90.3829	1.63374	7.98338	100.0000
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69	100.0000	90.3829	1.63374	7.98338	100.0000
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94	100.0000	90.3829	1.63374	7.98338	100.0000
95	100.0000	90.3829	1.63374	7.98338	100.0000
96	100.0000	90.3829	1.63374	7.98338	100.0000
97	100.0000	90.3829	1.63374	7.98338	100.0000
98	100.0000	90.3829	1.63374	7.98338	100.0000
99	100.0000	90.3829	1.63374	7.98338	100.0000
100	100.0000	90.3829	1.63374	7.98338	100.0000

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# Coal Macerals Quantification

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- **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

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# Challenges

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

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# Project 4: Face Detection

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- **Objectivo**

- Identify that there is a human face in a picture

- **Motivation**

- Facial recognition
- Biometrics
- Improved Auto-focus

There is someone here!



# 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>

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# Support material

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- [http://en.wikipedia.org/wiki/Facial\\_recognition\\_system](http://en.wikipedia.org/wiki/Facial_recognition_system)
- <http://www.myheritage.com/FP/Company/tryFaceRecognition.php>

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# Project 5: Pedestrian / Vehicle Detection

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- **Objective**


- Detect and track object motion on images captured by static cameras

- **Motivation**

- Video surveillance
- Intrusion alarms
- Crowd monitoring





A grainy, black and white CCTV video frame showing the interior of a school cafeteria. In the foreground, two young men are walking. The one on the left is wearing a white t-shirt and dark pants, carrying a rifle. The one on the right is wearing a dark shirt and light-colored pants, also carrying a rifle. They are walking towards the right side of the frame. The background is filled with round tables and chairs, many of which are occupied by other students. The lighting is bright, coming from large windows on the left side of the frame.

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.

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# Typical approach

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- 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/>

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# Support material

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

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# Projects

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