CV 10/11
Course Projects

MAP-i Doctoral Program

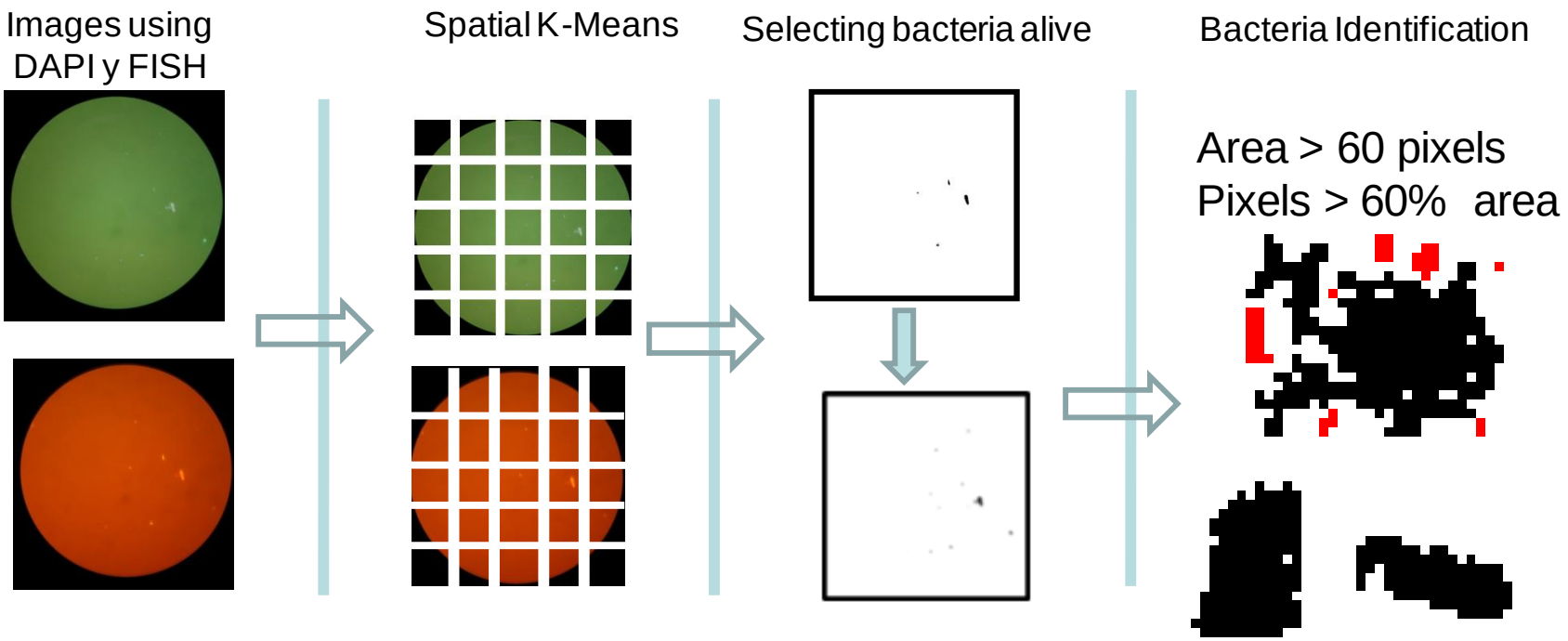
Miguel Tavares Coimbra

U.PORTO FC

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



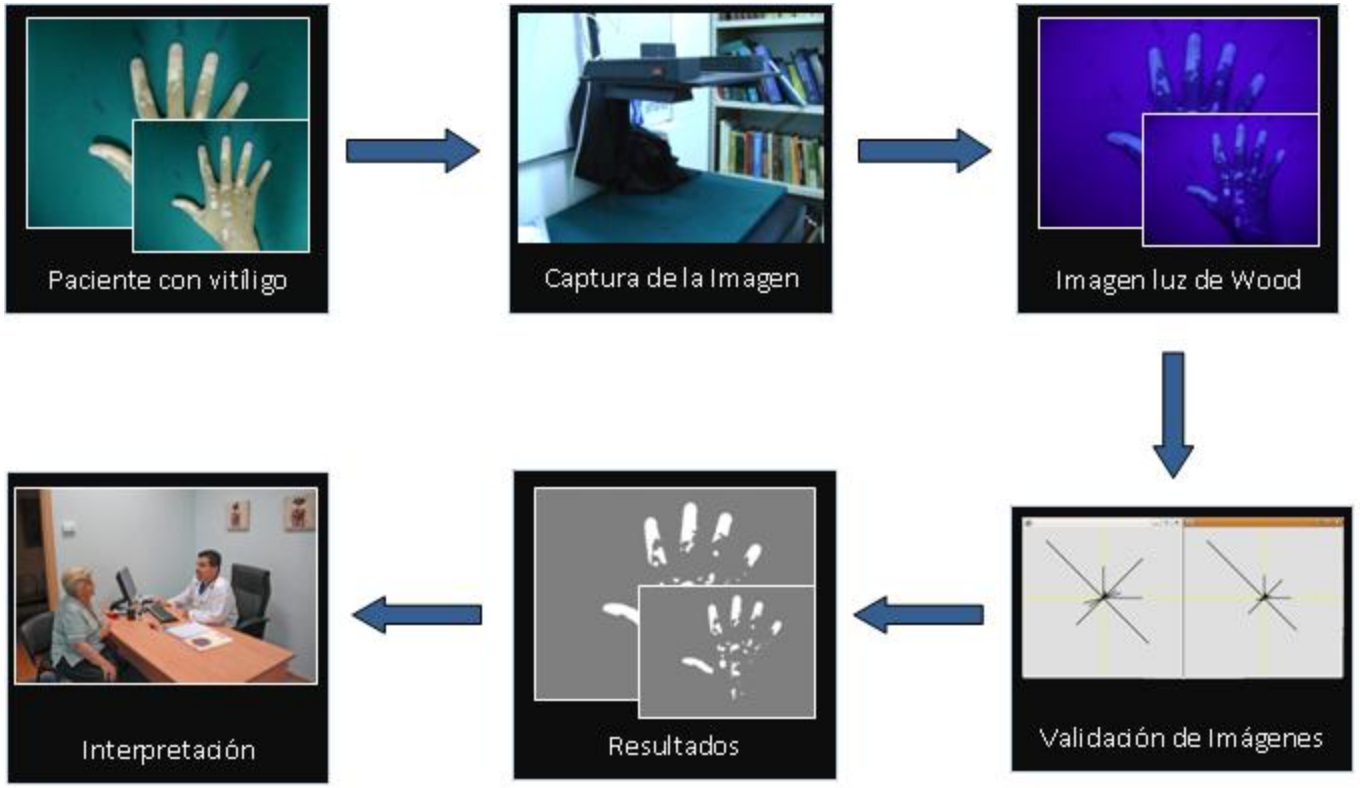
Residual water quality analysis

- 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

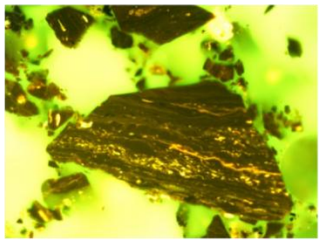
- Objective
  - Quantify the hand skin area affected by Vitiligo
- Motivation
  - Monitor the evolution of Vitiligo's disease in a patient.
- Institutions
  - Universidad del Valle, Colombia
  - Hospital Evaristo Garcia, Colombia

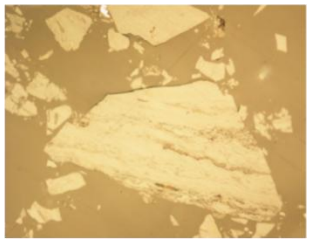
Challenges

- 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

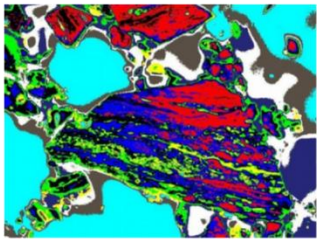
Project 3: Coal Macerals Quantification

Imágenes de microscopia en luz azul y luz blanca





Imágenes segmentadas con K-Means



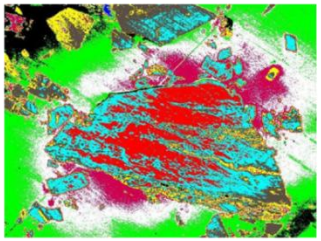
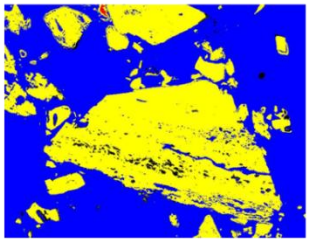
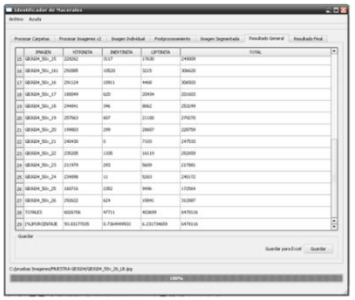


Imagen con grupos macérales:

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



Resultados de cuantificación de una muestra de carbón



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 Neurosicence, Vol. 3, No. 1, 1991, pp. 71-86

Popular topic but this is **The Paper**

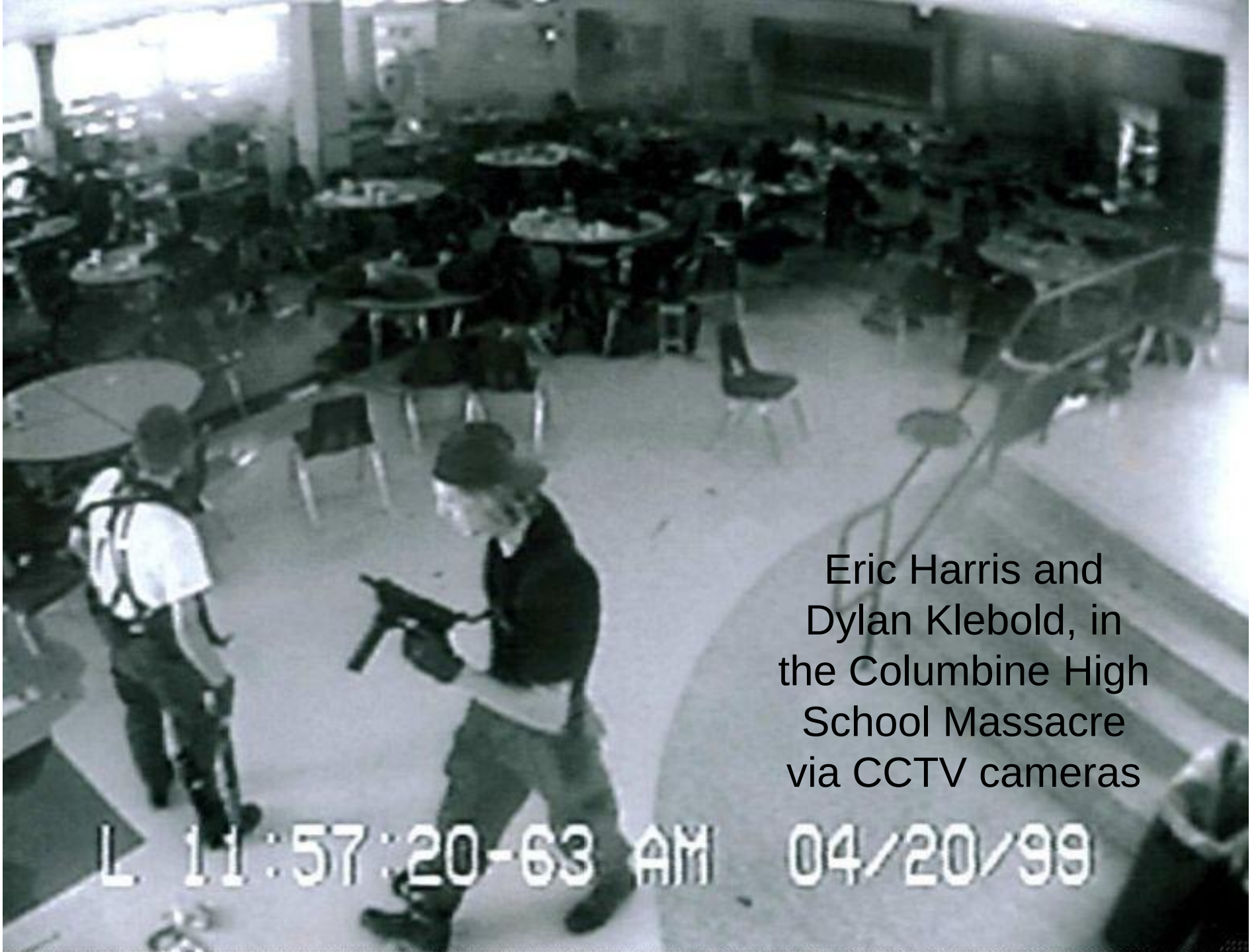
http://www.cs.ucsb.edu/~mturk/Papers/jcn.pdf

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

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.csuhayward.edu/~tebo/Classes/6825/ivcnz00.pdf
  - http://www-staff.it.uts.edu.au/~massimo/BackgroundSubtractionReview-Piccardi.pdf

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- Your proposals!