20th UITIC
INTERNATIONAL TECHNICAL FOOTWEAR CONGRESS

Porto 2018
16th–18th MAY

FROM FASHION TO FACTORY
A New Technological Age

"Virtual fitting room based on augmented reality"

Dr. Javier Cortés Cameros. Project Management Office

FOOTWEAR TECHNOLOGY CENTER OF LA RIOJA

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MISSION Innovation for the future

Private non-profit association

- I+D+i to **create added value**
- Improvement of the **industrial competitiveness**
- **Certification** of quality
- **Over 10 years of experience** offering technological solutions

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FACTS & FIGURES

- **+ 110 associated companies**, 80 % of them are footwear manufacturers or distributors.
- **+ 170 clients** have contracted **390 specialized** services.
- The team of **CTCR** is composed of **24 people**.
- Around **28-30 projects per year**, with an average budget of **1.3 million €**.
- Over **4,000 workers** have participated in more than **5,673 hours** of training.

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KNOW-HOW

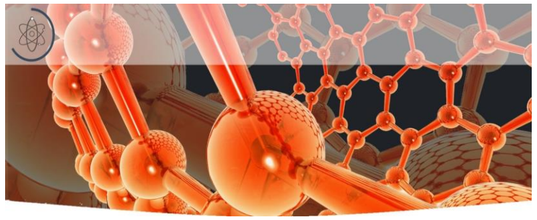
ICT

Mechanics & Prototyping

Electronics & Automation

Environment & Biotechnology

Nanotechnology & New Materials



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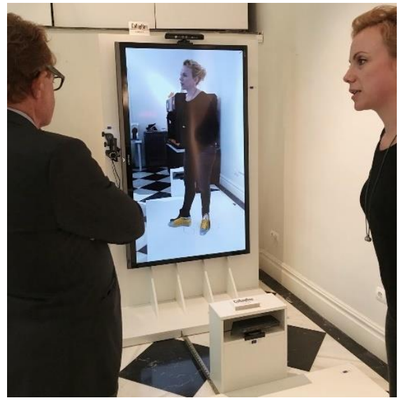

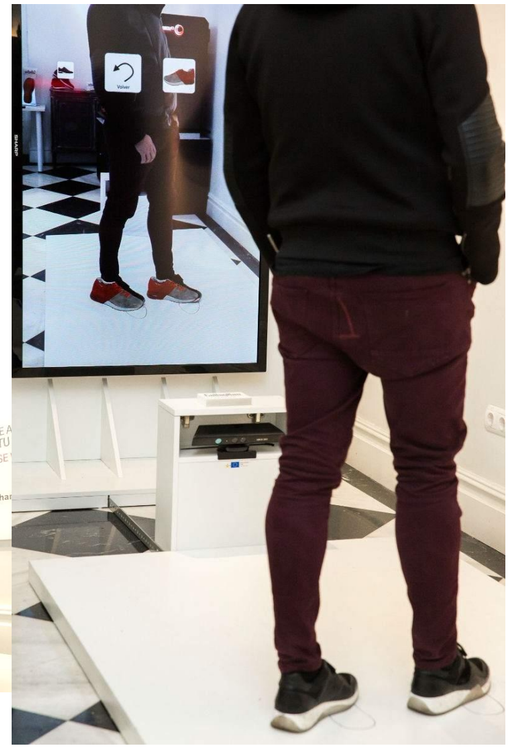

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OBJECTIVES

- New algorithm for the **compression and decompression of images** in real time
- **Augmented reality** created through images and 3D models.
- **Kinesthetic virtual fitting room** that can work in real time.
- **Positioning and movement** of the virtual shoe:
  1. **Show the suitable picture of the shoe.**
  2. **Vector precision +/-2º.**
  3. **16,380 pictures per model.**
  4. **Combination of models and colours in real time.**

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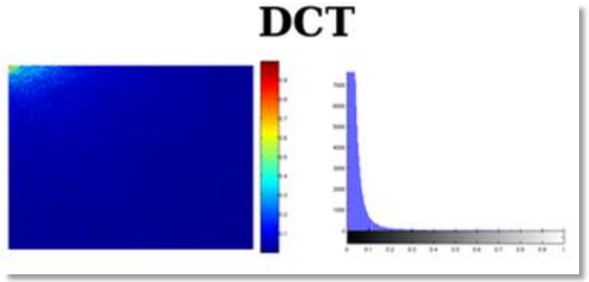
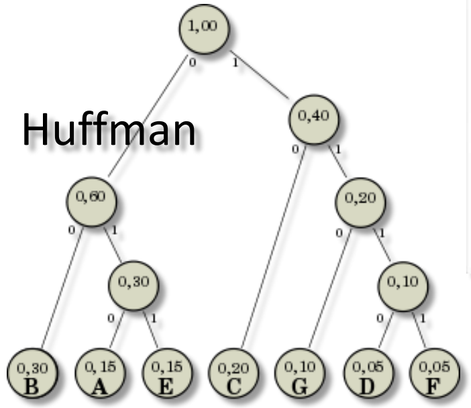
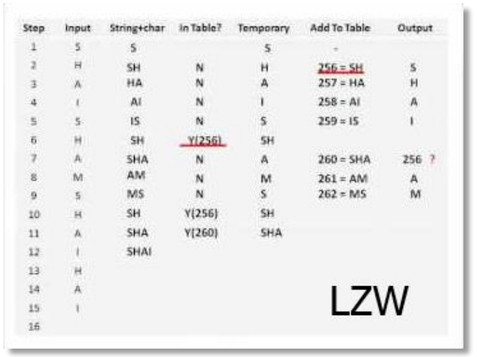
STATE OF THE ART

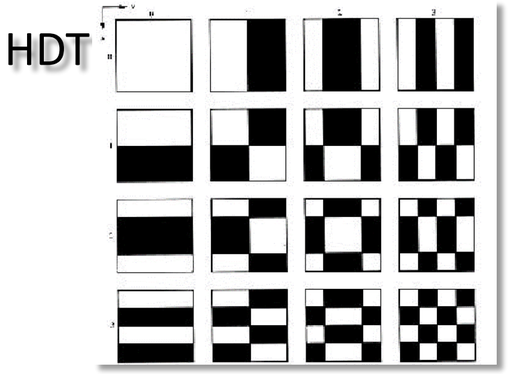
Study of the Art was focused on compression algorithms currently used to compress and decompress images:

- Lossless Algorithm Lempel-Ziv
- Discrete Bi-dimensional Cosine Transform
- Discrete Hadamard Transform
- Huffman Algorithm.









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SYSTEM REQUIREMENTS

ID	Name	Description
1	Image and prediction algorithms	• Algorithms to compress images to enable the work with pictures in real time. • Algorithms to analyse which are the most probable images to be displayed and prepare them. • Technology to manage the data volume: 16,380 images with 1,600x1,600 pixels
2	User interface	• Easy use and accessibility. Validation with final users.
3	Pose system	• Developments to understand the position of the foot and transform it in a mathematic expression. • Developments for the augmented reality system.
4	Catalogue system	• Preparation of models and database.
5	Manufacturing of the virtual fitting room	• Structure and hardware
6	Marketing and sales	• User experience

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DESIGN AND MANUFACTURING OF THE PROTOTYPE

Active components:

- **Videocamera.**
- **TV screen.**
- **Kinect sensors.**
- **Frame structure.**
- **Specifically designed computer.**

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INTERFACE

Best interfaces are based on the dynamic interpretation of movements and the displacement of graphic elements on display as options of a menu.

Kinect vs Leap Motion: Kinect has a wider action range and enough accuracy.

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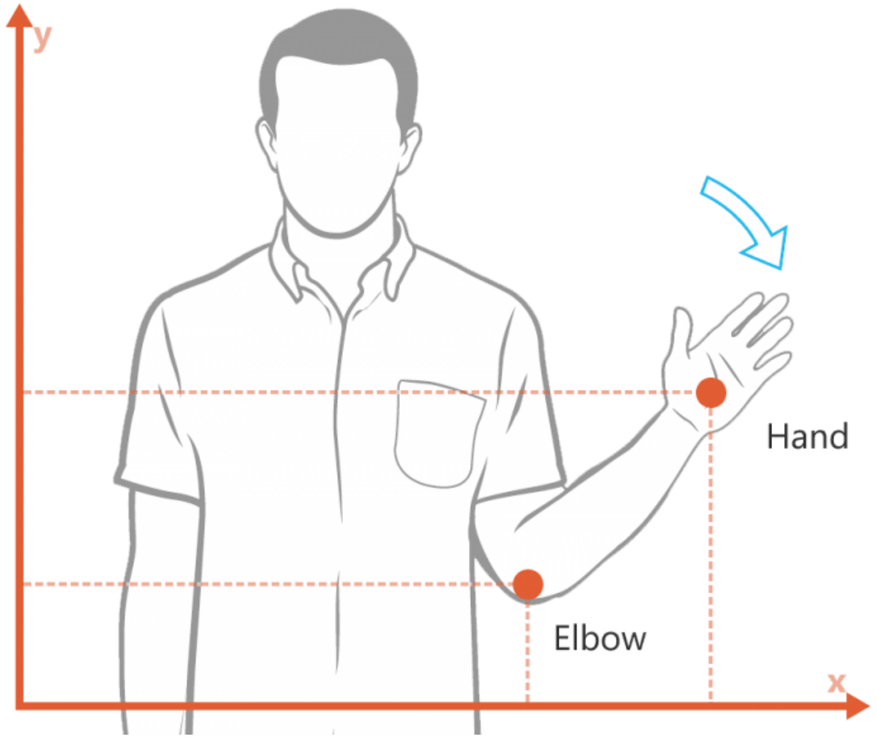
INTERFACE

- Selection through positition of the hand
- Selection through displacement of the hand
- Selection through angle hand-elbow
- Selection through wheel
- Static-time pulse
- Pushing pulse



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POSE SYSTEM

- Feet tracking:

  Kinect sensors, SDK and ShoeMirror software.

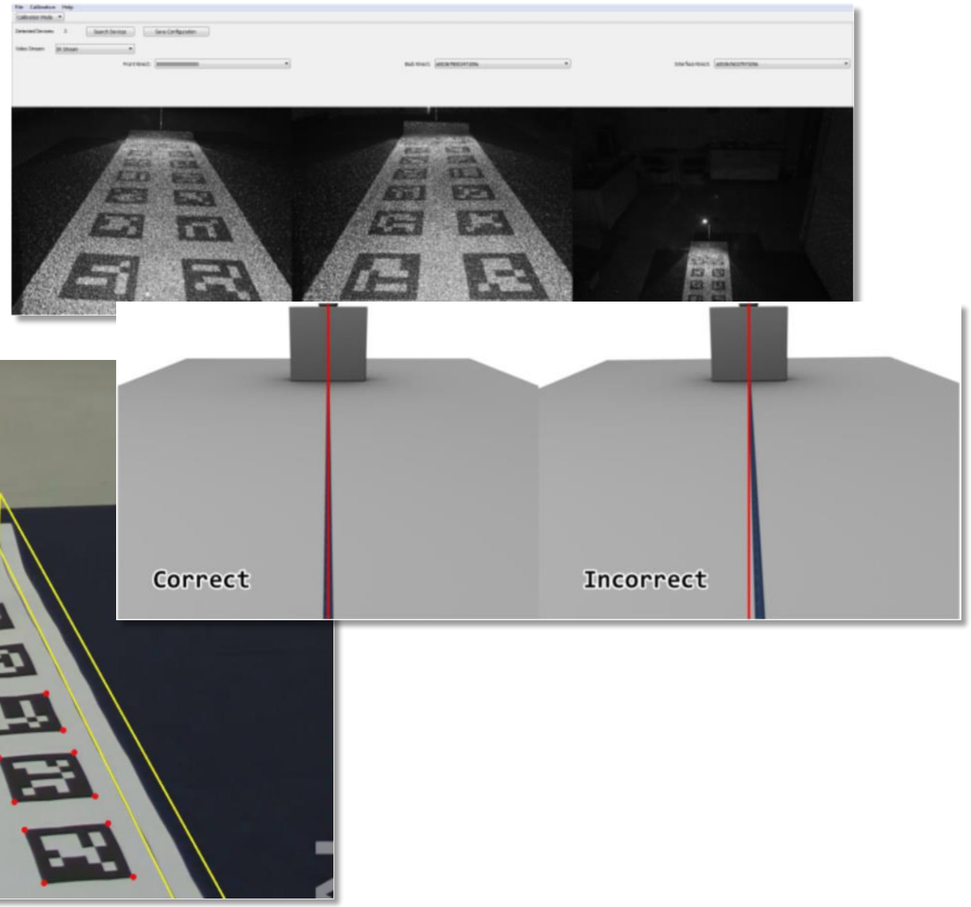
  Calibration and detection of the feet.

- Visualisation of the renderised model.

  Wavefront OBJ and OpenGL.

- Visualisation of photographed models

  Developed by CTCR.



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VISUALIZATION OF PHOTOGRAPHED MODELS

- Model defined by several photographs (PhotoShot360º).
- Format personalised by CTCR.
- Compression system developed by CTCR.

Algorithm	Complexity for compression	Complexity for decompression
LZW	$N \log_2 N$	N
Huffman	2N	N
RLE	N	N
DCT	$N \log_2 N$	$N \log_2 N$
HDT	$N \log_2 N$	$N \log_2 N$
EZW	$N \log_2 N$	$N \log_2 N$

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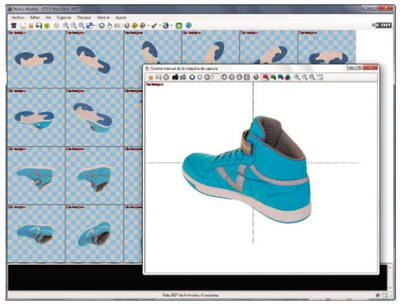
VISUALIZATION OF PHOTOGRAPHED MODELS

Precission:



Original **99,2%** **99,5%** **99,6%** **99,7%**

Minimum

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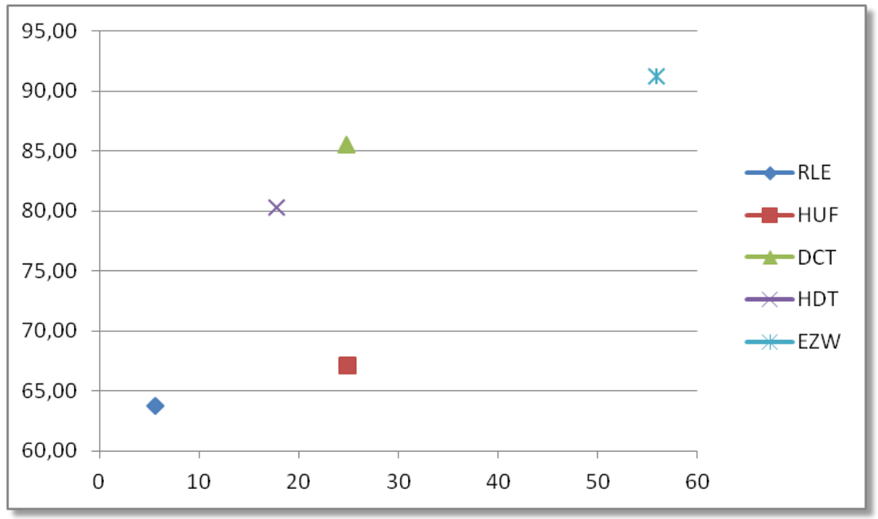
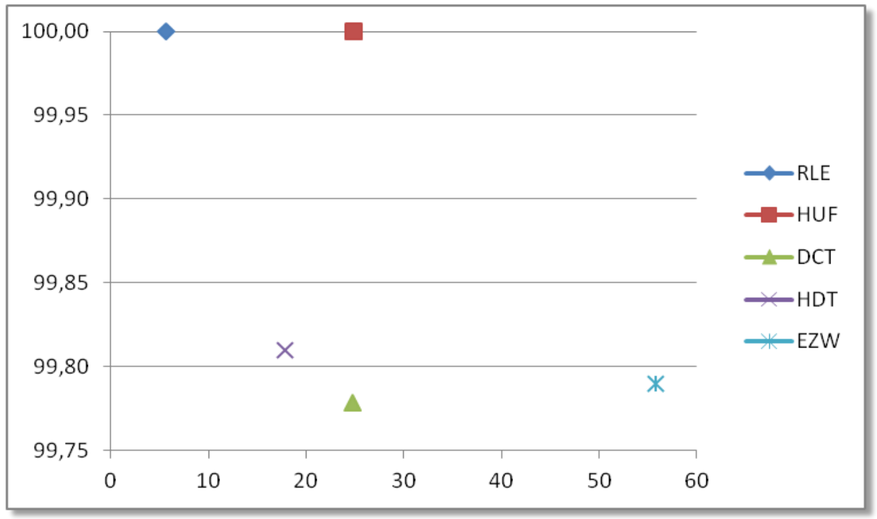
VISUALIZATION OF PHOTOGRAPHED MODELS

Comparison between compression methods:



Time vs Compression Rate



Time vs Precision

Solution: combination of HDT and RLE methods and codification through ALCrCb system (Alfa, Luminance, red Crominance, blue Crominance)

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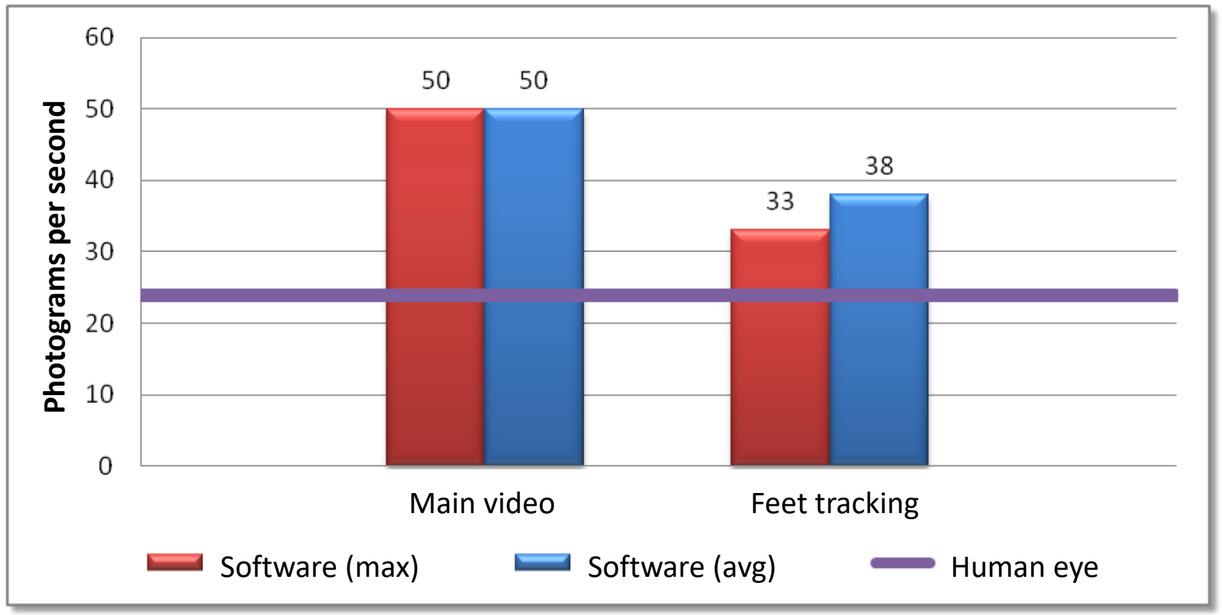
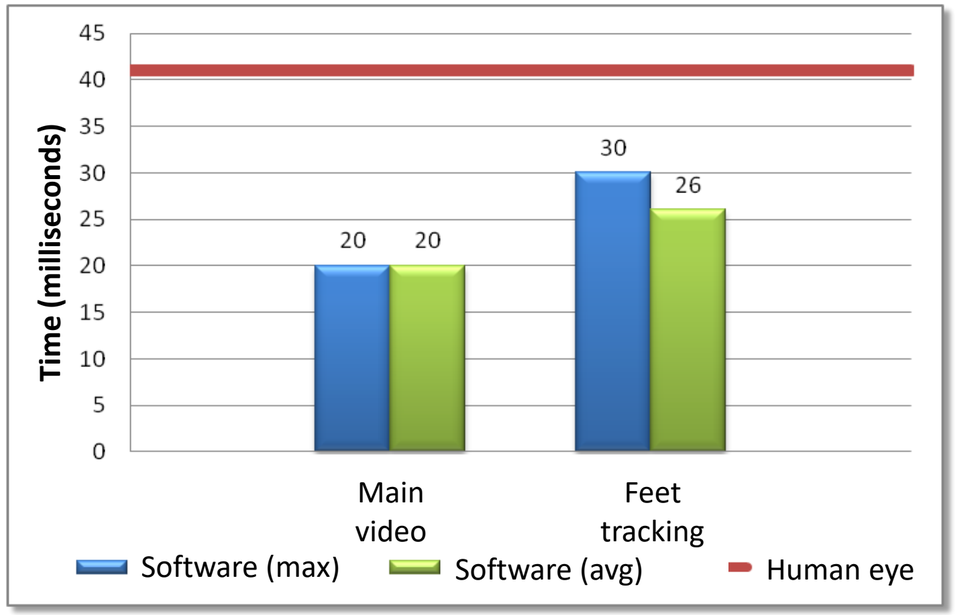
PERFORMANCE OF THE SYSTEM: PARALLEL RUN





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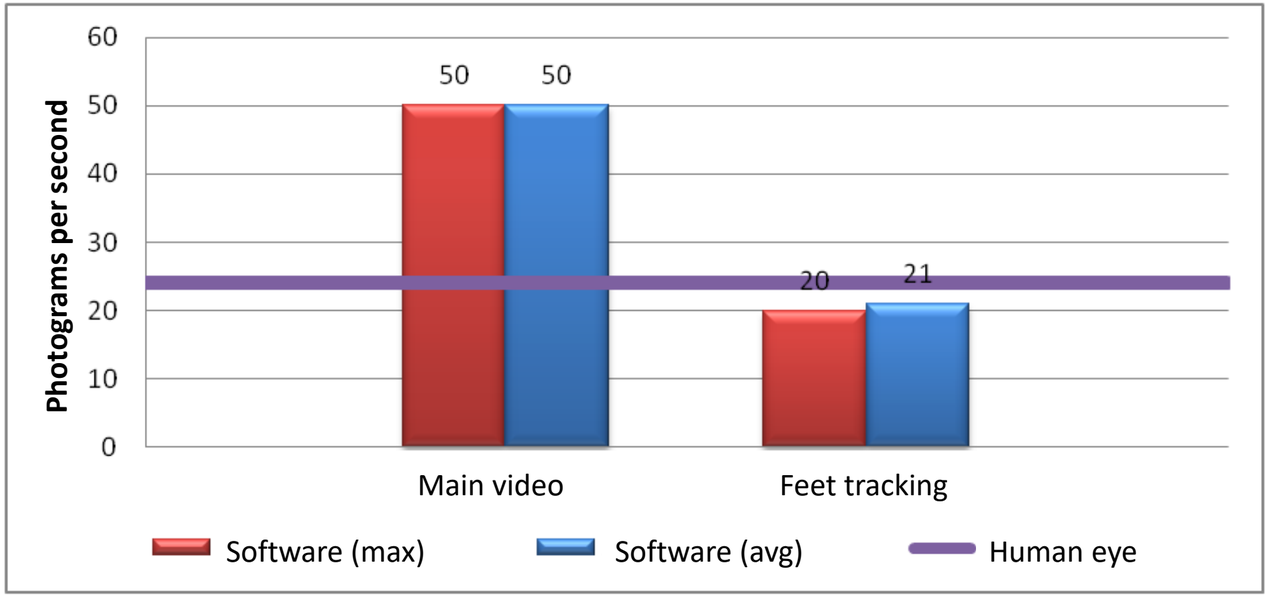
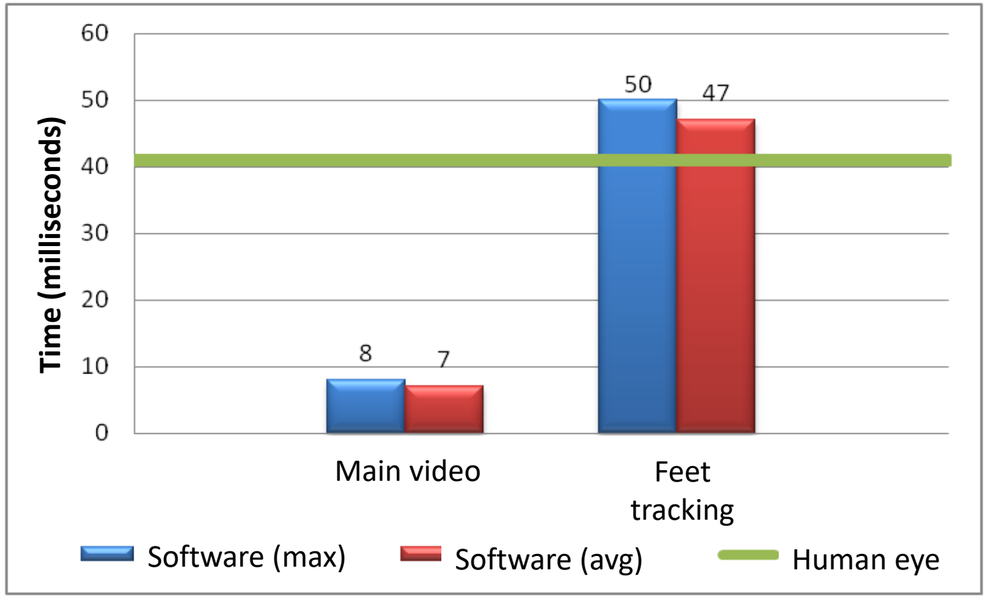
PERFORMANCE OF THE SYSTEM: SEQUENTIAL RUN





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ADVANTAGES

- The **customers** will improve the shopping experience and will have the service of a virtual personal shopper. They will count on the whole catalogue, not only the shoes that are in the shop.
- The **shop** will increase its sales, because the customers will enjoy at the shop and the service offered will be better.
- The **manufacturer** and the **shop** will obtain valuable data from the virtual fitting room: most interesting models, most used sizes, favourite colours…

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Thank you for your attention

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