



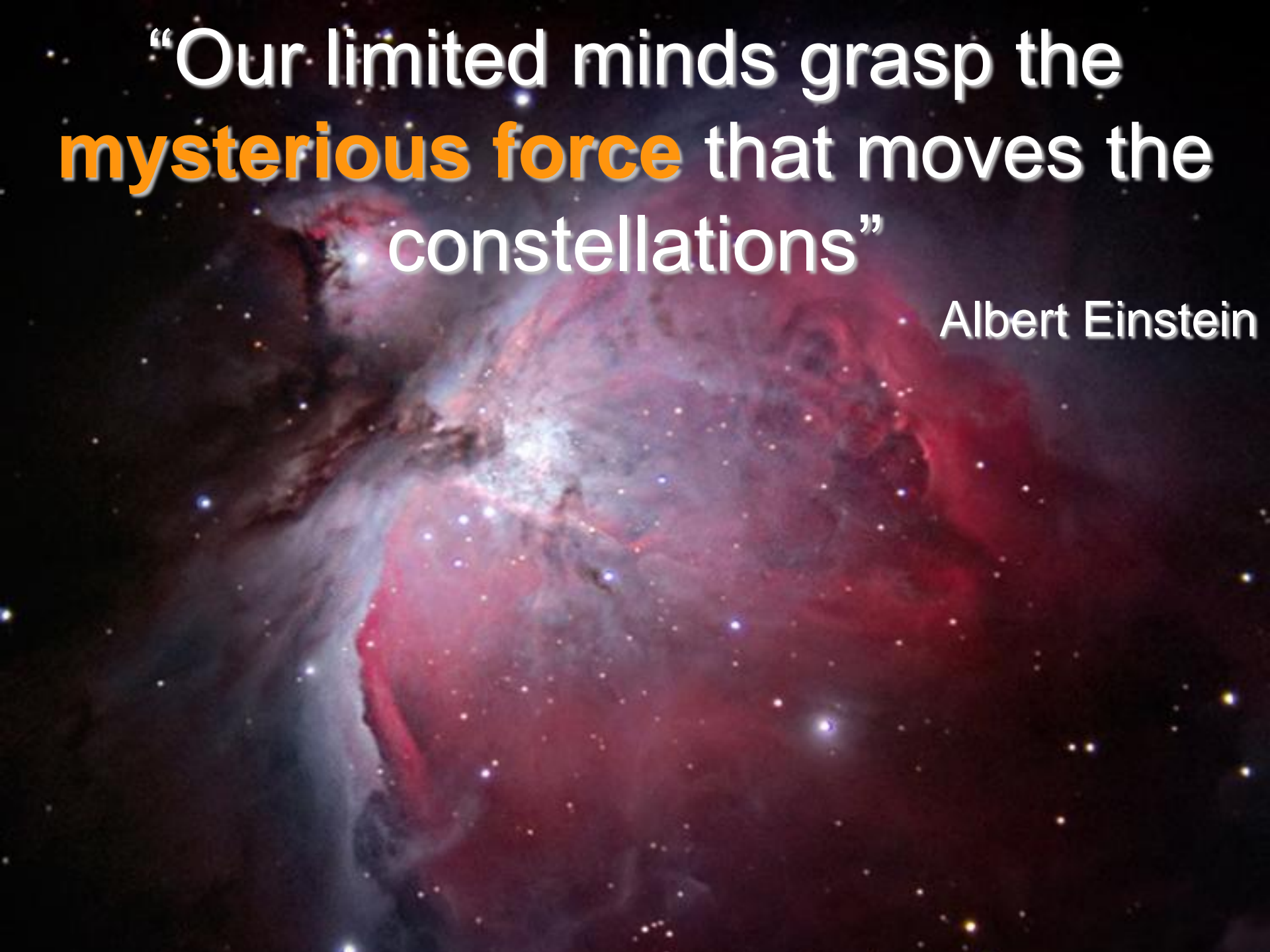
*Interactive Multimodal Pattern Recognition in Embedded Systems (IMPRESS 2010)
Bilbao, Basque Country, 1-3 September 2010*

Recognition of Secret Banknote Patterns

Javier Nieves, Igor Ruiz-Agundez, Pablo G. Bringas

“Our limited minds grasp the
mysterious force that moves the
constellations”

Albert Einstein





Danger also extends to **physical documents**

Document protection has always
been there through **history**



Nowadays, the **most**
protected documents are...

...the **banknotes**



For instance, **Euro** banknotes have
the following **types of**
protection...

The **Intaglio Printing** is in the
Euro banknotes



There also is a
watermark



The **security thread** is embedded
in the banknotes



A **representation** of the banknote amount which is fully displayed when it is held up against light



Holograms can be seen in the
banknotes



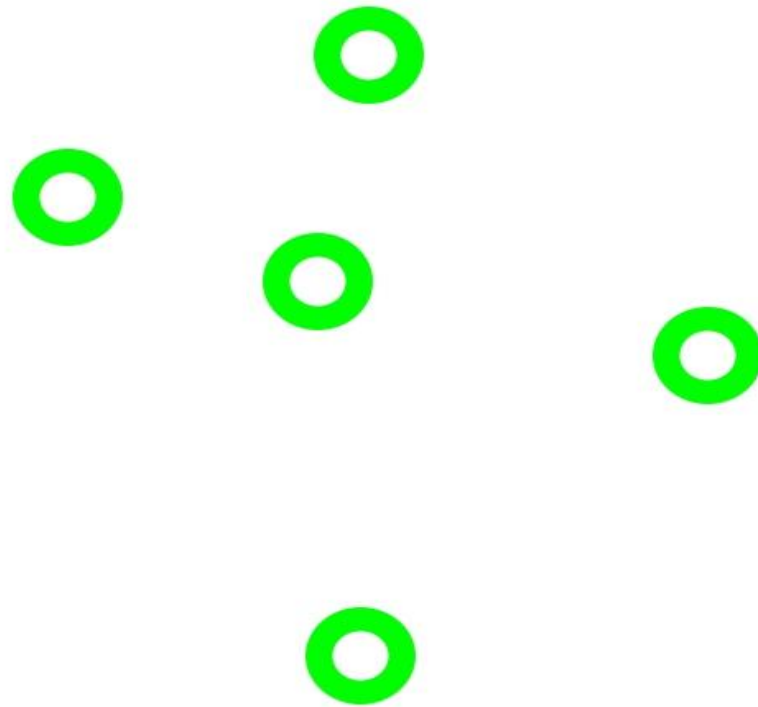
Moreover, **the ink** used in banknotes **reacts** in a different way to different types of **light**



TOP SECRET

Although there is **hidden security...**

... such as the **EURion constellation**



Who created the pattern?



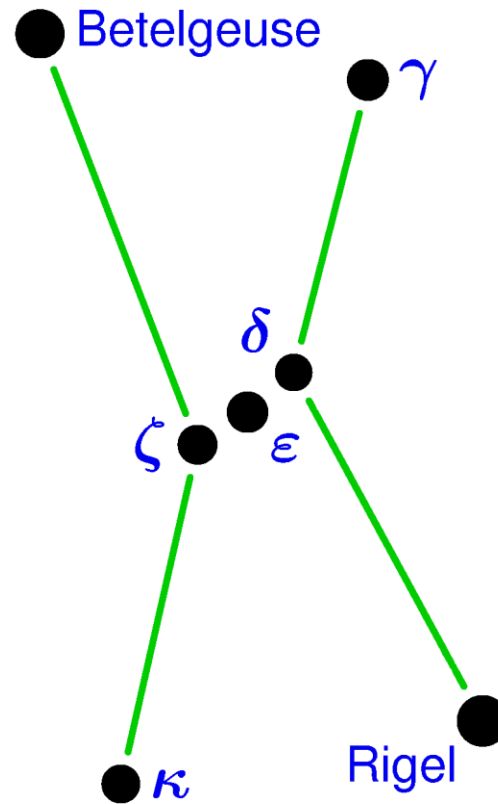
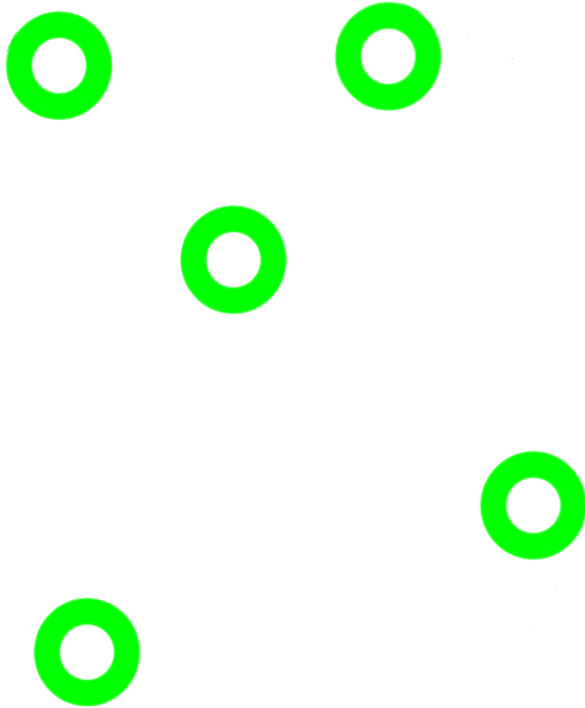
Who discovered the pattern?



Dr. Markus Kuhn



And its **name** come from...



Although it was first detected in the Euro banknotes, **it can be found in other banknotes**





Our **experiment** starts using the previous knowledge

The **origin was** the failure in the banknote reproduction process





STOP

It can be used to **stop** other frauds

By **recognising this pattern** in the
physical documents



Hence, the **EURion constellation** can be used to **protect our documents**

Checking the reproduction without constellations



Checking the orientation



Checking colour of the constellations



Checking the number of constellations



Checking the completeness of the constellations



Checking the size of the constellations

The pattern which **avoids**
the reproduction...

1

“Needs at least **one**
constellation”

2

“The constellation must
be **complete**”

3

“The drawing **colours** are:
green, orange and yellow
with some irregularities”

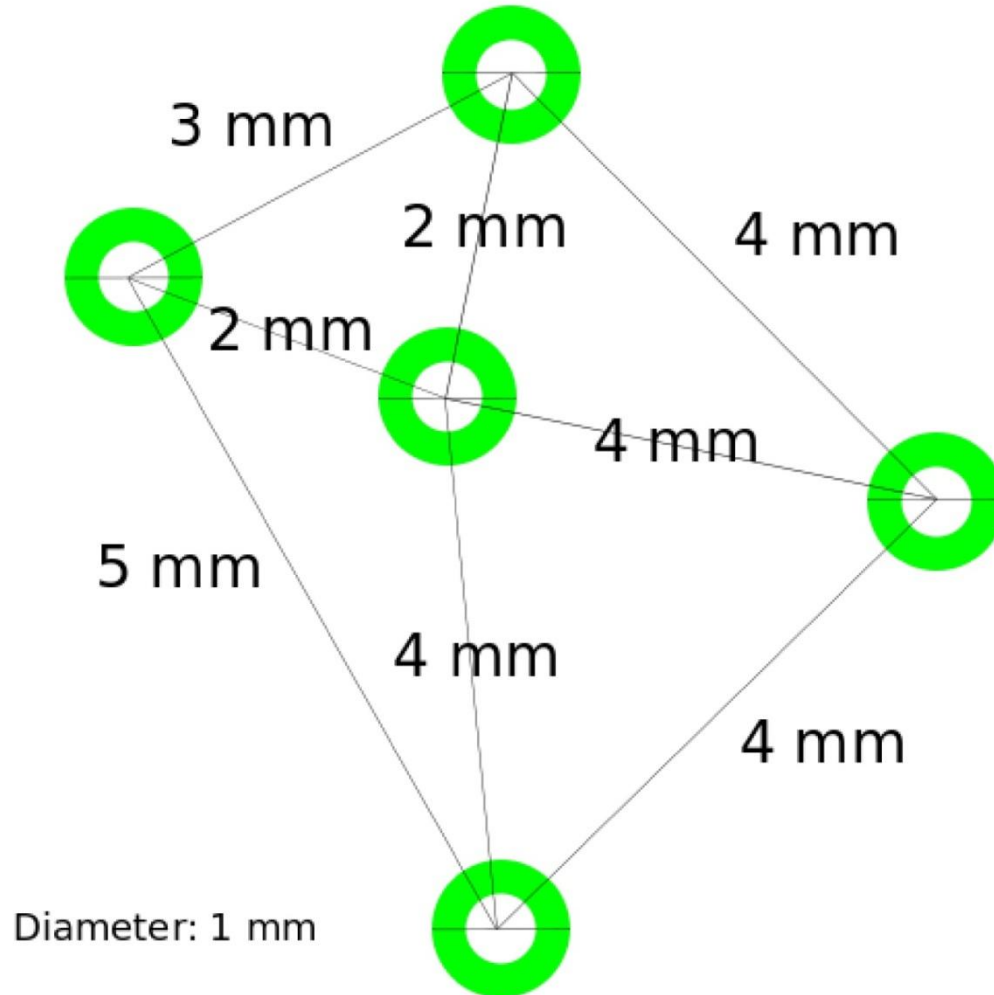
4

“The **orientation** of the constellation is not taken into account”

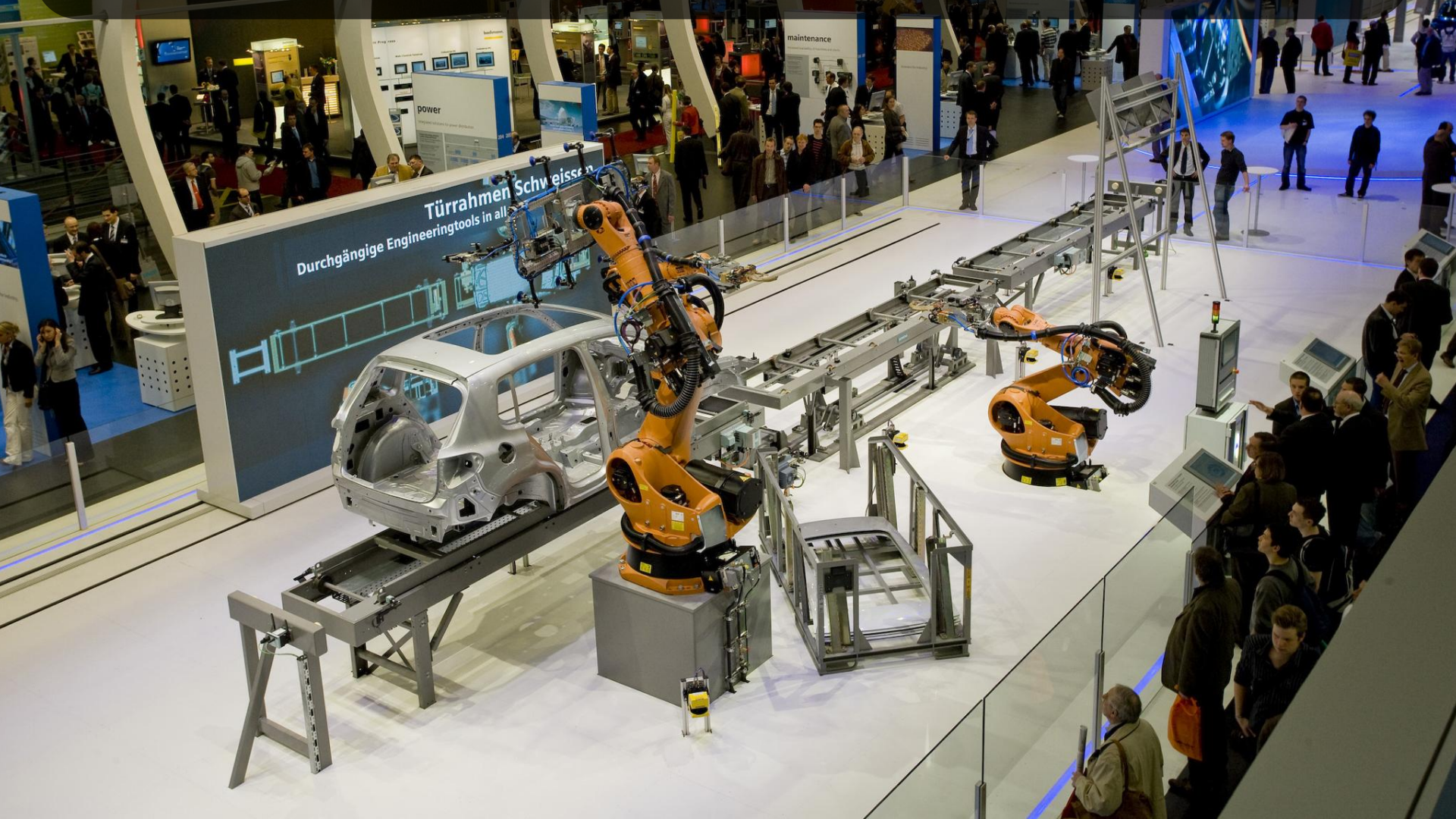
5

“The measure of the **constellation** must be always the **same**”

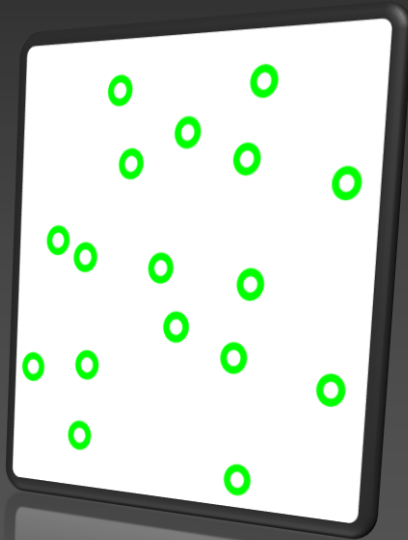
The **measure of the constellation** is the following:



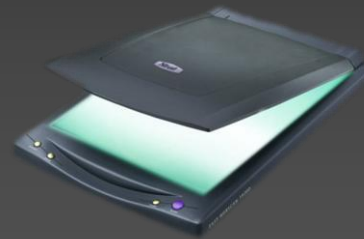
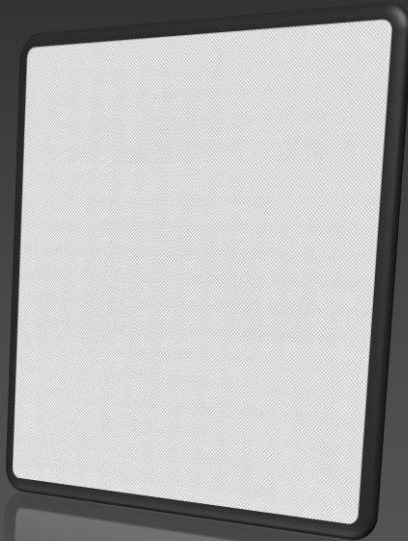
From reverse engineering to **reuse** engineering



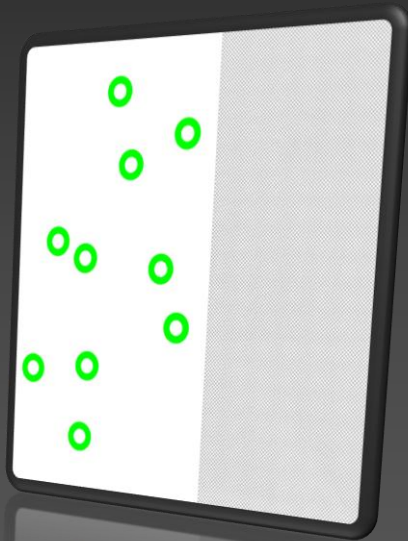
The test achieved these
results



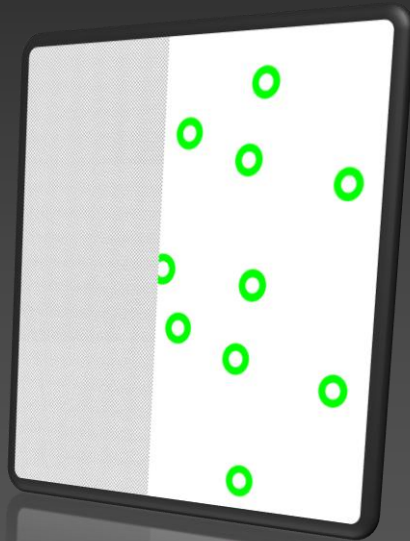
The test achieved these
results



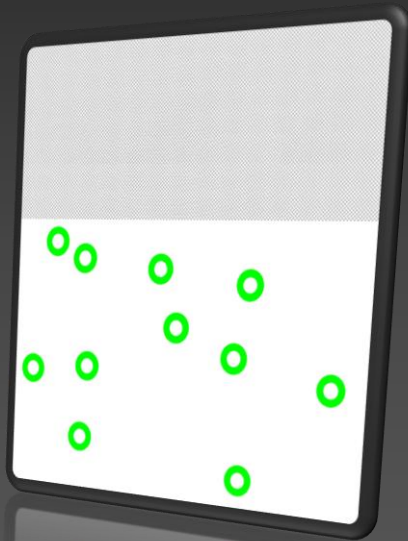
The test achieved these
results



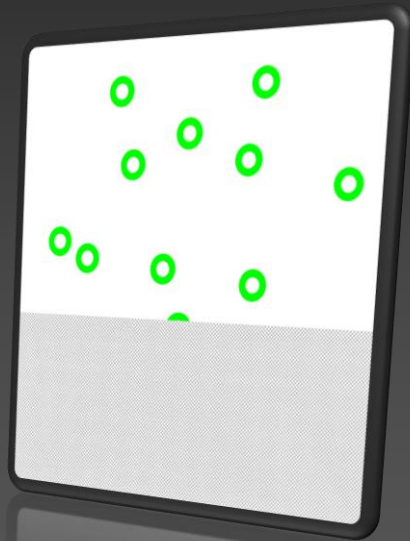
The test achieved these
results



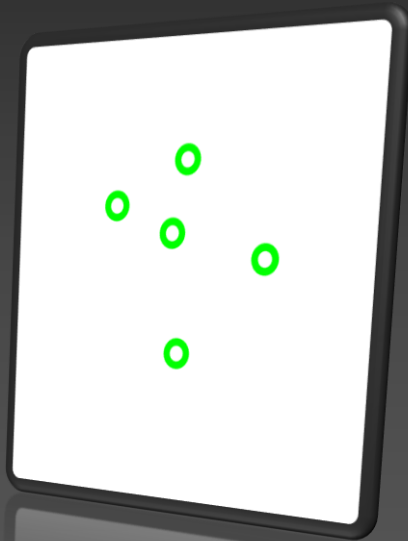
The test achieved these
results



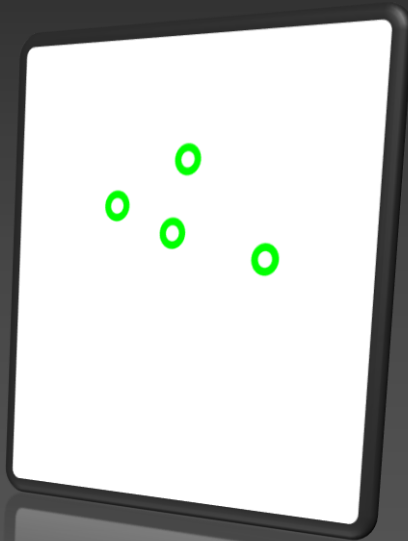
The test achieved these
results



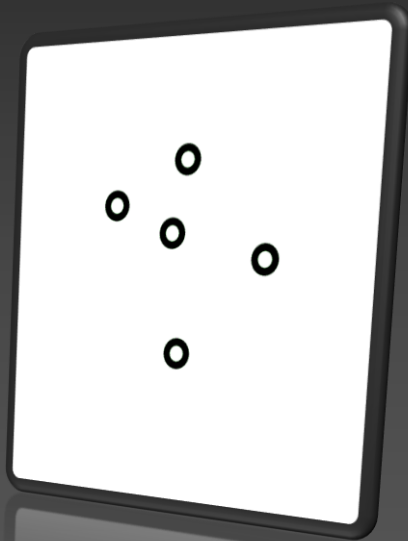
The test achieved these
results



The test achieved these
results



The test achieved these
results



Note:

Not all the hardware and software packages support this feature. Most of them **will include** it, **in the foreseeable future.**

A photograph of a lush green fern forest. A winding wooden boardwalk path made of light-colored planks curves through the dense vegetation. The ferns are various shades of green, and the scene is filled with natural light filtering through the canopy.

Following the winding **road** we can
assure the physical documents **will be**
protected



*Interactive Multimodal Pattern Recognition in Embedded Systems (IMPRESS 2010)
Bilbao, Basque Country, 1-3 September 2010*

Recognition of Secret Banknote Patterns

{jnives, igor.ira, pablo.garcia.bringas}@deusto.es