



Maestría en Ingeniería en Sistemas y Cómputo Inteligente

Web system for monitoring patients with multiple sclerosis

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*Symposium
de Posgrado*



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1. Introduction

Multiple sclerosis (MS) is a disease of the nervous system that affects the spinal cord and the brain, causing messages between the body and the brain to slow down or become blocked. This disease frequently affects young people between 20 and 40 years of age, although it can also occur in children or older adults. [1]

In Mexico, there are around more than 20 thousand cases, that is between 18 and 15 incidents per hundred thousand inhabitants.

In this project describes the comparison between multiple sclerosis tomograms of at least 38 patients [2], among which we find MRI images of the first (month 0) and second examination (6 to 12 months). The tomographies allow evaluating the evolution of this condition (MS), by applying discrimination and segmentation techniques through machine learning and computer vision in the images.

	Dijango	CakePHP	Ruby on Rails
Visual Content Administration	X		
Version management	X		
Flexible architecture	X		
Assistants		X	
Compatibility		X	
Components		X	
Editing in frontend	X		
Permit management	X		
Handling exceptions			X
Multilingualism	X		
Multisites	X		
MVC	X	X	X
Template		X	
Support			X

Table 1. Comparison of general characteristics among the most popular web frameworks to carry out the Web System [3].

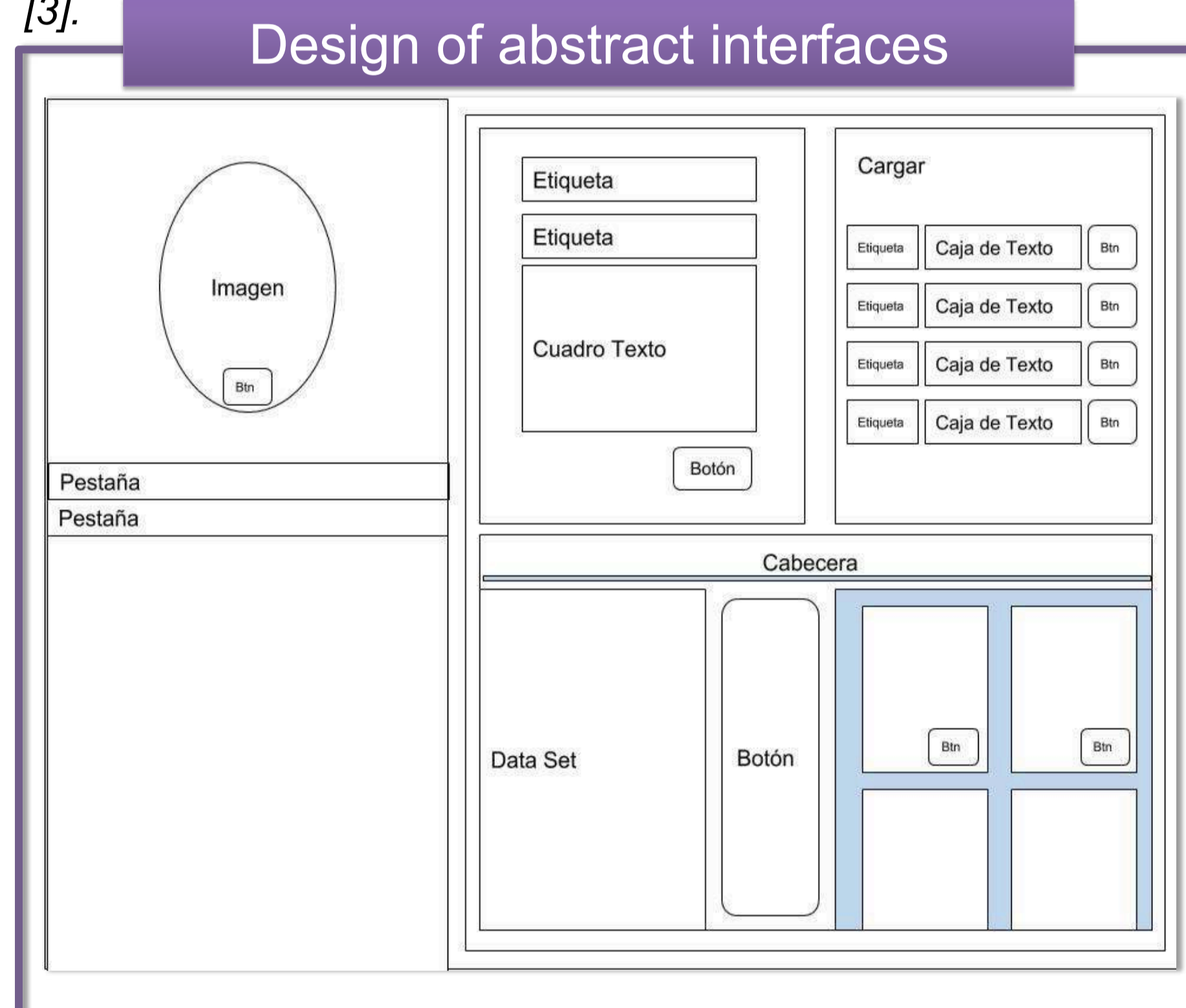


Figure 2. Structure of the relevant aspects of main user interface prior to implementation.

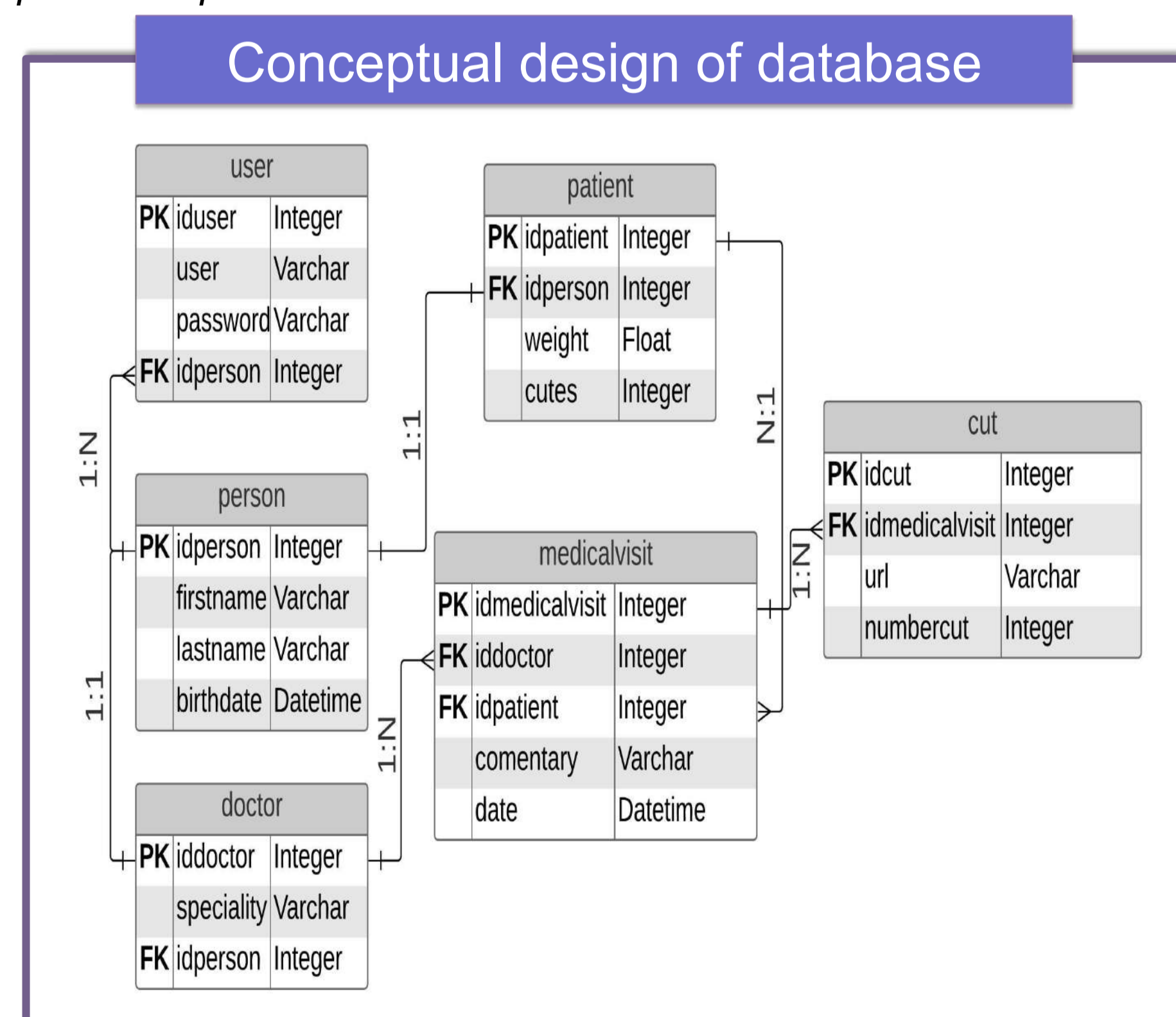


Figure 3. Conceptual scheme based on user requirements for the assessment of MS

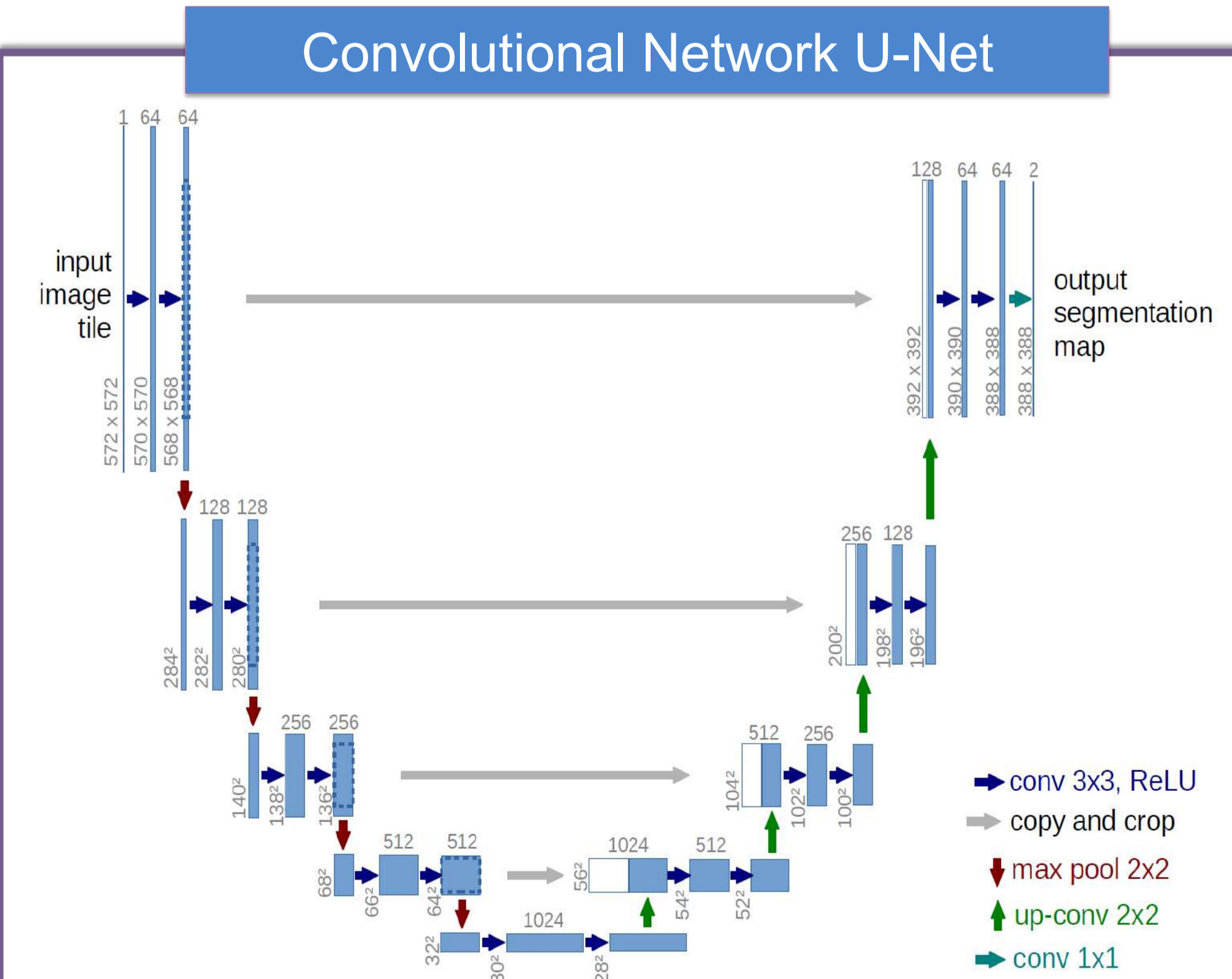


Figure 4. U-net architecture (example for 32x32 pixels in the lowest resolution). Each blue box corresponds to a multi-channel feature map. [4]

4. Results



Figure 5. Database of classified IRM images for training and testing

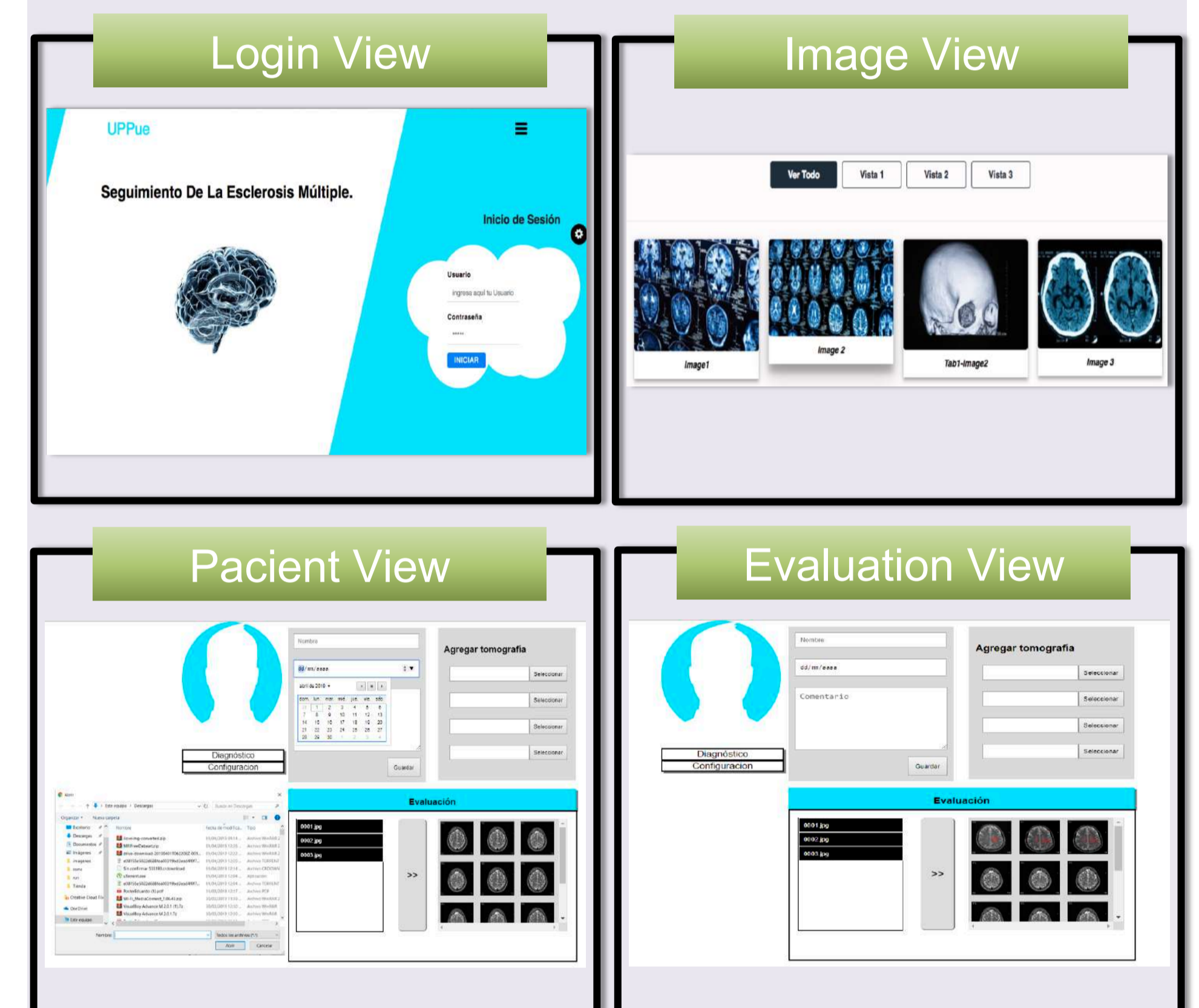


Figure 6. Online web system, this detects the evolution of white lesions caused by multiple sclerosis.

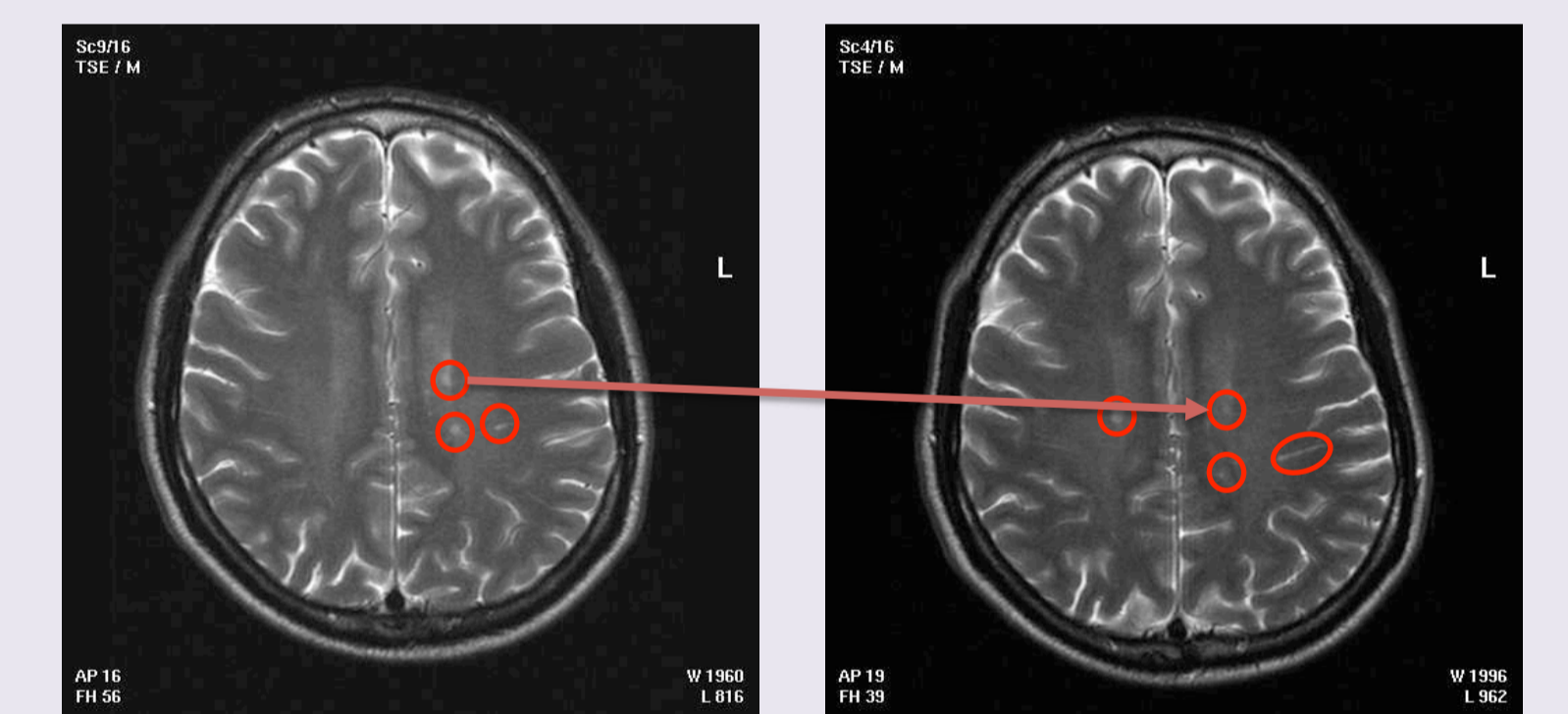


Figure 7. Comparison of an MRI image of the first study (month 0) and of the second one (month 6 to 12), marking the affected areas using U-NET

5. Conclusions

Based on the above methodology, as a preliminary result, we obtained a multiuser web system capable of evaluating one or more horizontal cuts of the brain. The use of the convolutional neural network (U-Net) helped segmentation and removal of main features for abnormal recognition white lesions in the brain, which represent the advanced evolution of MS. Different tests were performed with a free images database of 38 patients with multiple sclerosis with the disease already detected. As a continuous work, tests continue to be carried out to obtain the accuracy that is best established in the state of the art of this project.

Acknowledgements

This research is supported by CONACYT Scholarship 864121. PNPC.

References

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2. Objectives

2.1. General Objective

Develop a semi-automated web system that allows neurologists to verify the evolution of multiple sclerosis of patients by applying computer vision.

2.2. Specific Objectives

- Design a user interface for access to the web system by implementing usability heuristics.
- Structuring a database that is suitable for the efficient storage of information.
- Identify, modify and apply computer vision techniques to evaluate disease progression and classification.

3. Methods

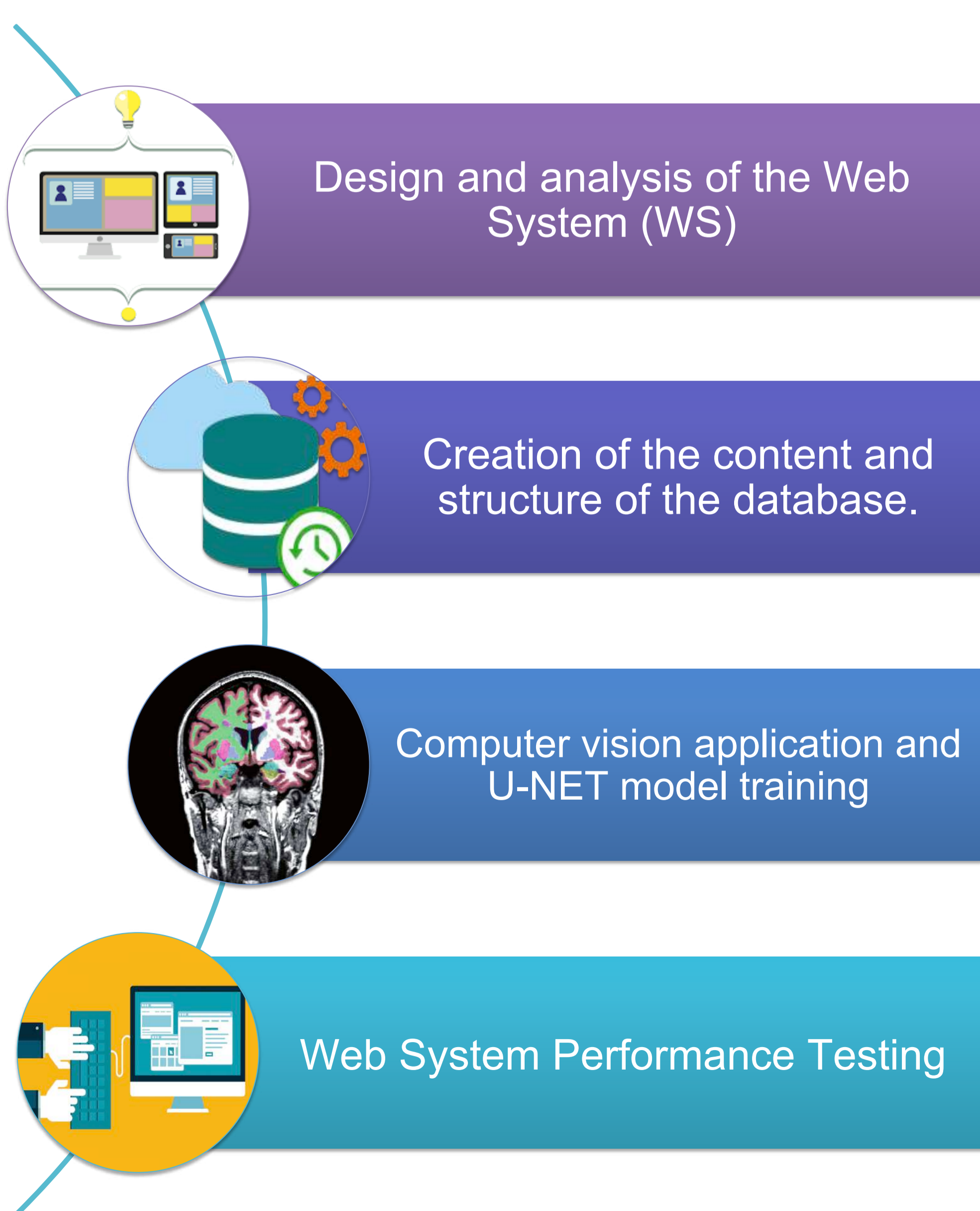


Figure 1. Methodology for development a web system that verifies the evolution of MS



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