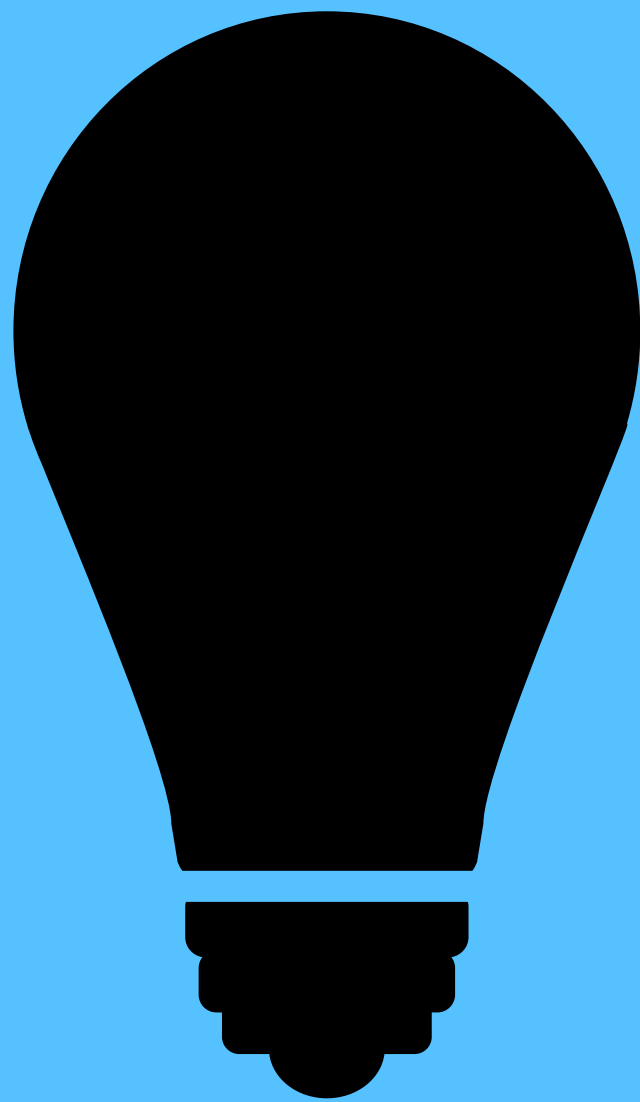




Fourier.AI

Surgery Automation

THE CONCEPT



Our project stems from the vision of being able to perform **fully automated** surgeries. Managing to **maximize** the probability of success and **minimize** the human and resource **cost**.

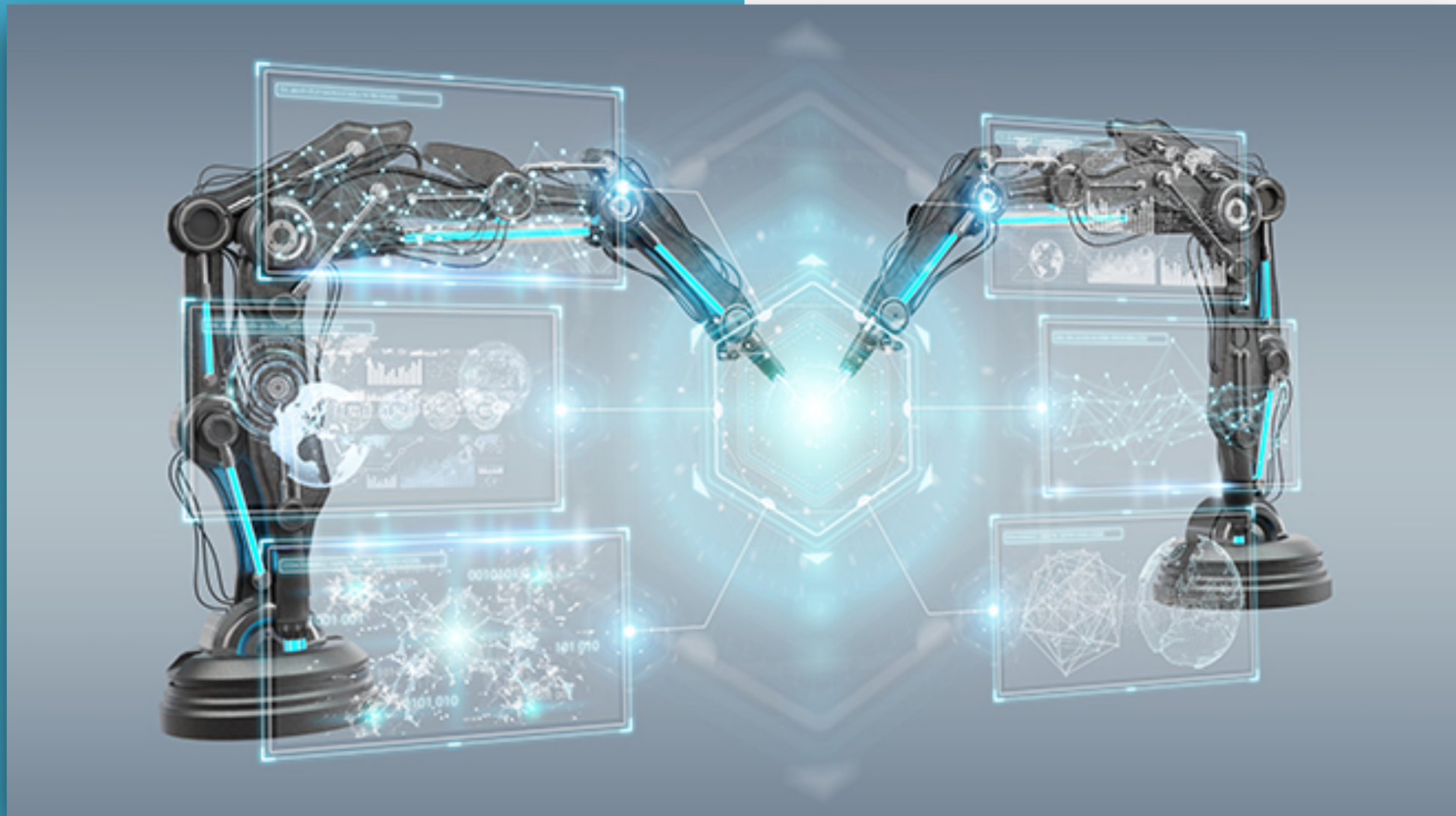
SURGICAL CONTEXT



In an environment as **full of variables** and unexpected events as that of **a surgery**, the idea of entrusting such a task to a **machine** may be dismissed at first.

It is precisely for these reasons that an interesting application of **Artificial Intelligence has its place.**

FOURIER.AI

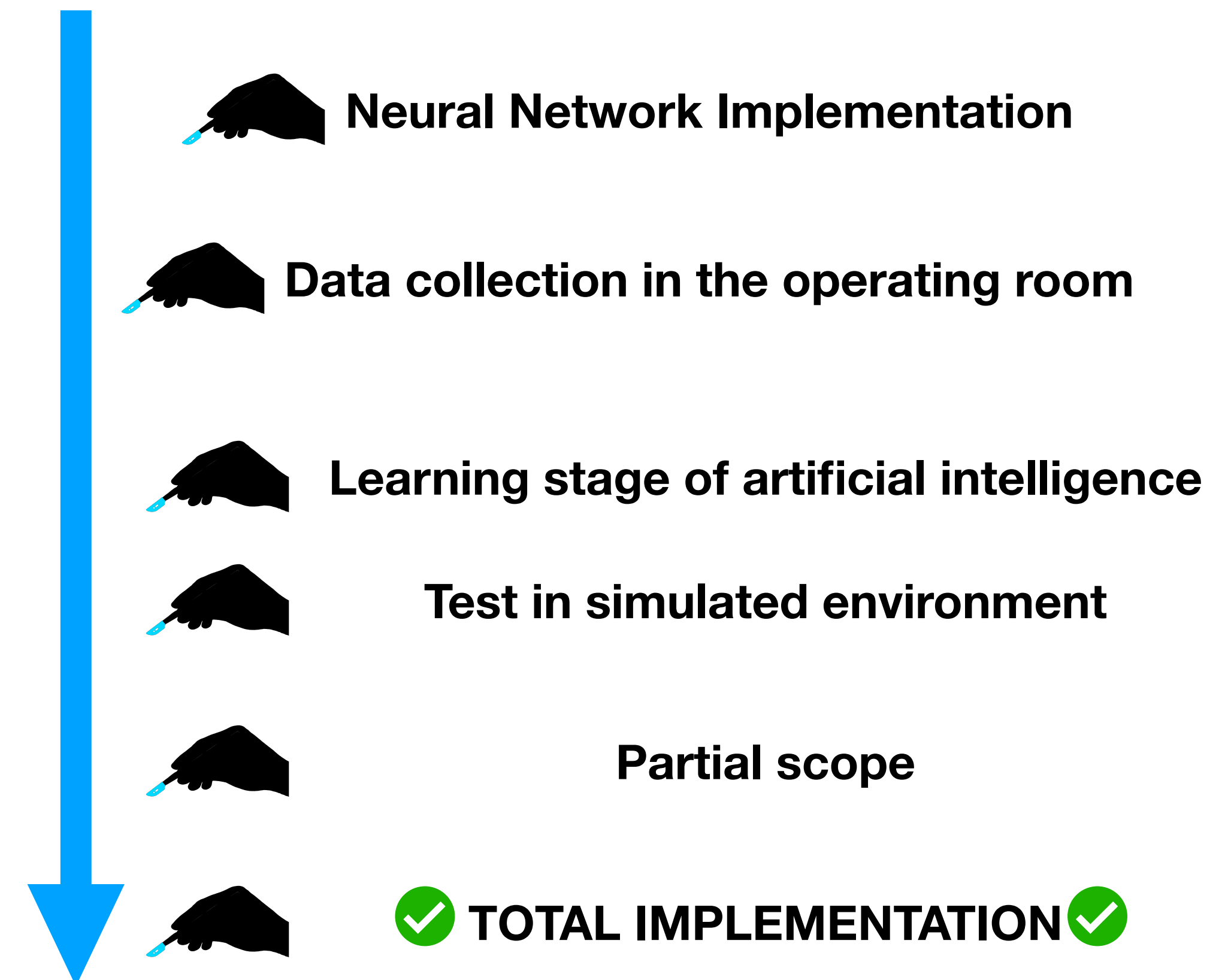


Thus was born **Fourier.Ai**. A multidisciplinary project that manages to unite **engineers and surgeons** for the creation of an intelligent system capable of **preserving and creating knowledge in the surgical field.**

To save lives and to give birth to the **prospect** of performing surgical operations until now at the limit of the unthinkable **because of their complexity and human effort.**

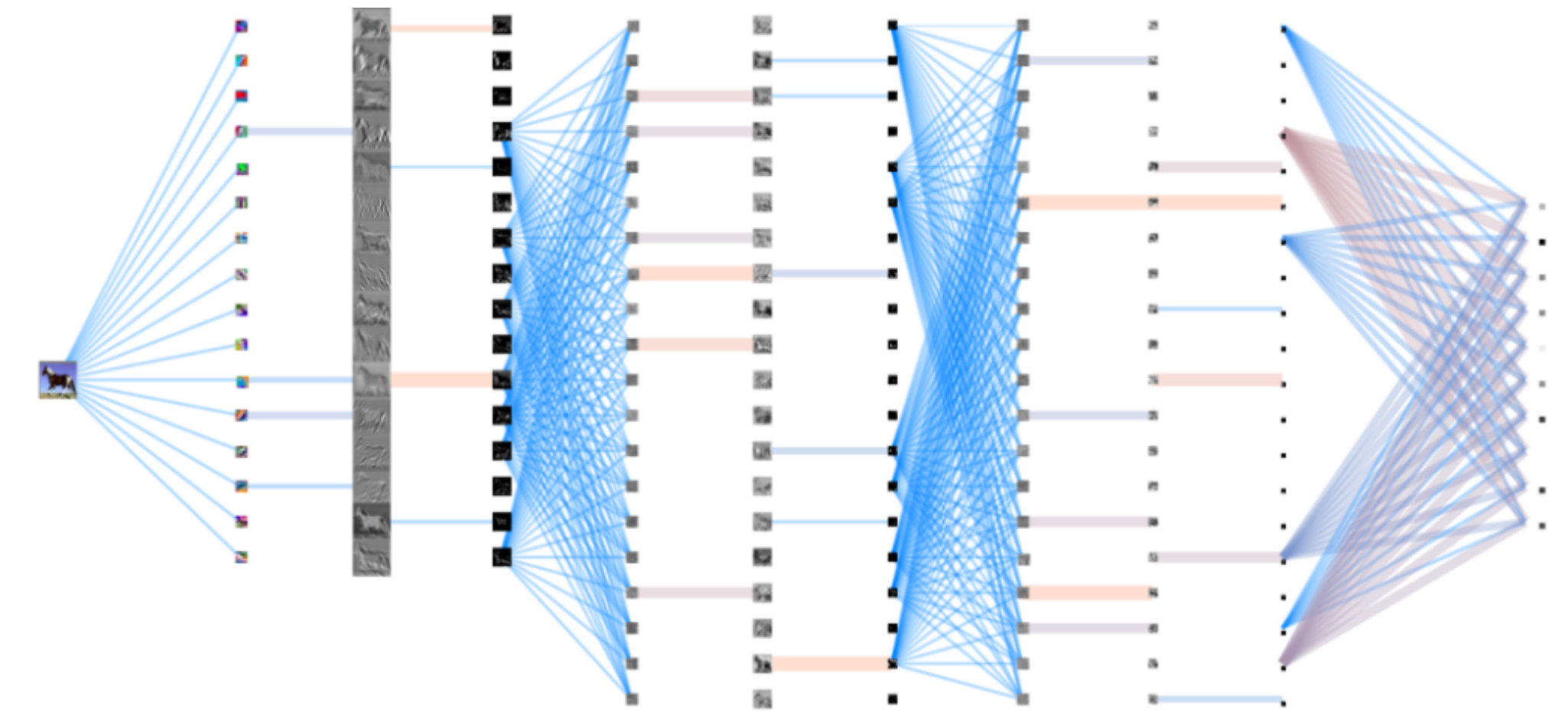
DEVELOPMENT

The creation of such a tool requires the **use of numerous technologies**, articulated in different **stages** of development and according to the stage of the project itself.

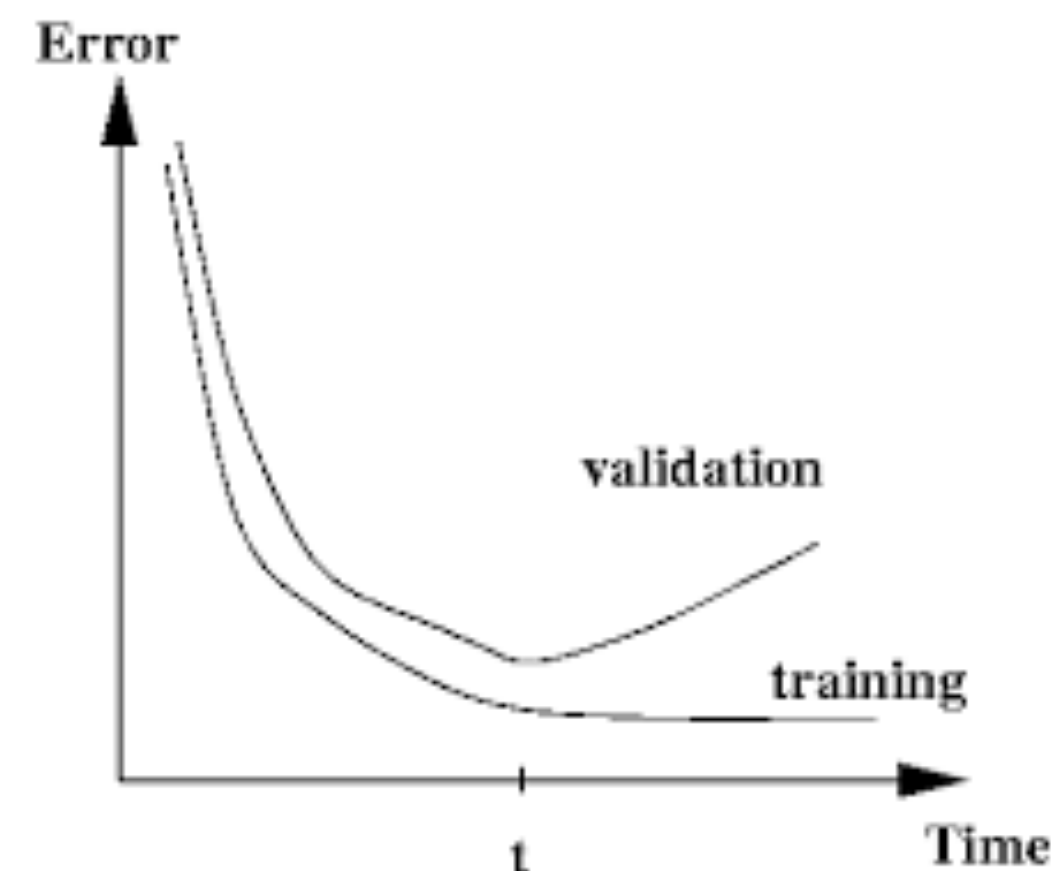


NEURAL NETWORK

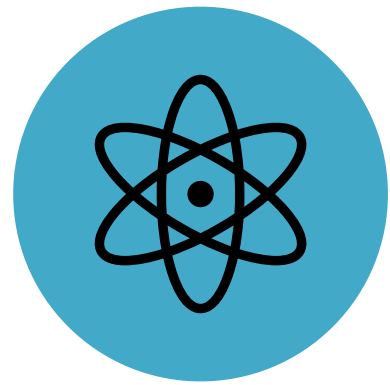
It will constitute the Core part of the project, it will have to be realized taking into account the large amount of data to which it will be subjected, their frequency and the degree of complexity of data processing.



The structure of the neural network will be of **multilayer** type, realized with a programming language able to provide **speed of execution and reliability**. A good solution in the start-up phase of the project could be to use the **C++** programming language.



NEURAL NETWORK PERFORMANCE



Recognize quantities

It will have to recognize with **micrometric precision** all the spatial quantities concerning the surgical intervention (e.g. incision depth, position with respect to internal and external organs...).



Recognize tools

Gain **awareness of the tools used** during the operation, how often they are used, to accomplish what task, in what order.



React to unforeseen events and coordinate actions

Know how to **handle emergency situations** and acquire **chronological awareness** of the conduct of maneuvers during the intervention.

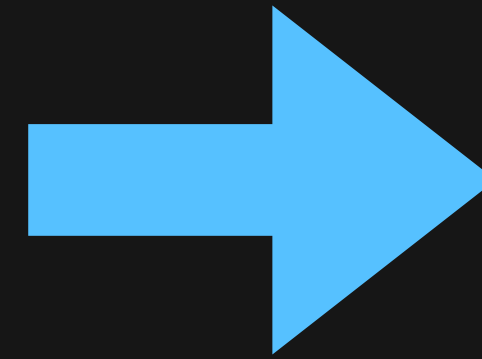


Distinguish Elements and Organs

Should be able to **distinguish** internal (e.g. blood) and external **elements** (foreign body in the patient). It will also need to **recognize organs** and their location in context.

DATA COLLECTION

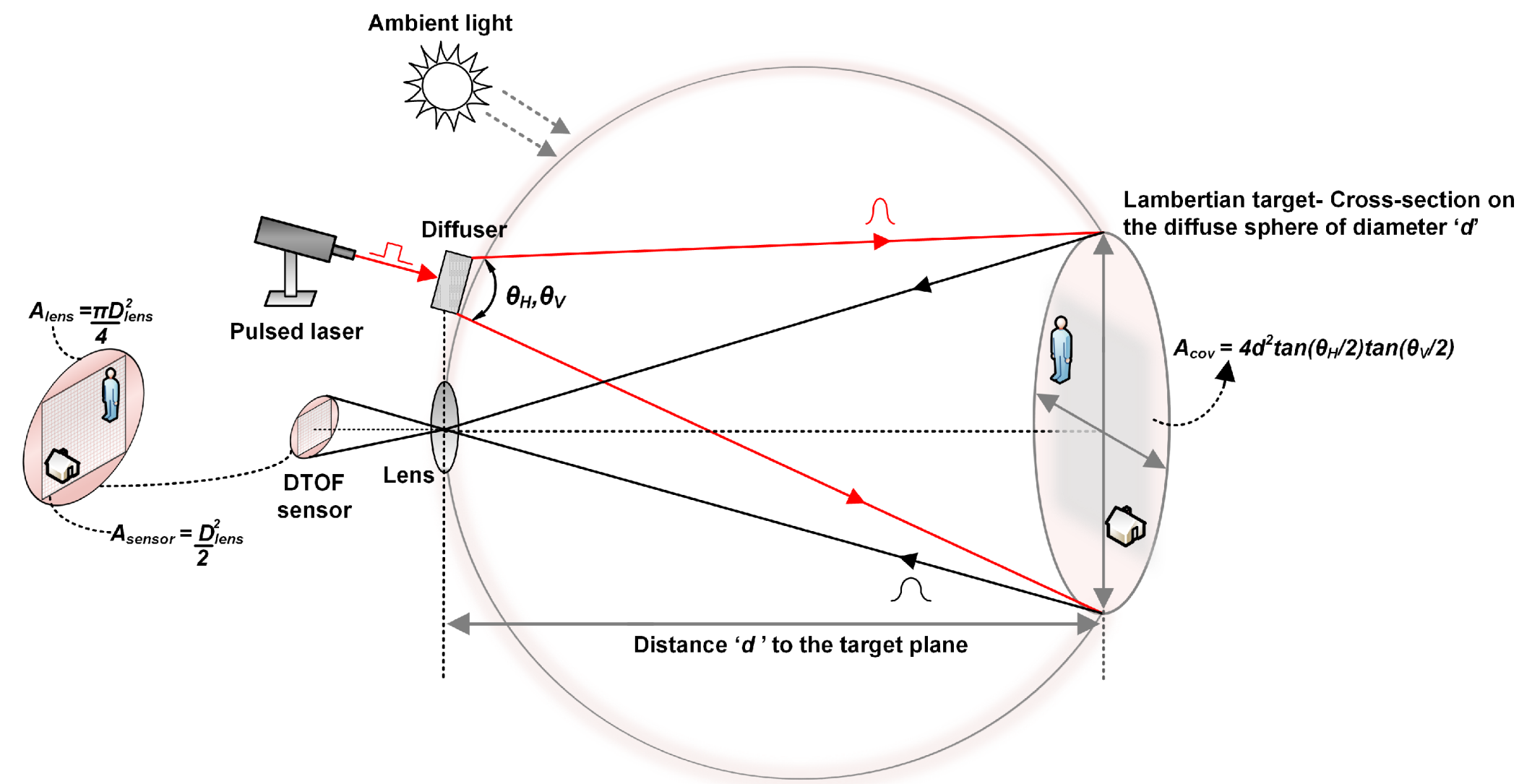
Feeding and learning the **Fourier.AI** neural network requires a **massive data collection** operation **divided by difficulty and type of surgery**.



At the same time, it is necessary that **data collection is non-invasive** and does not compromise patient **privacy** or the **proper performance** of the procedure.

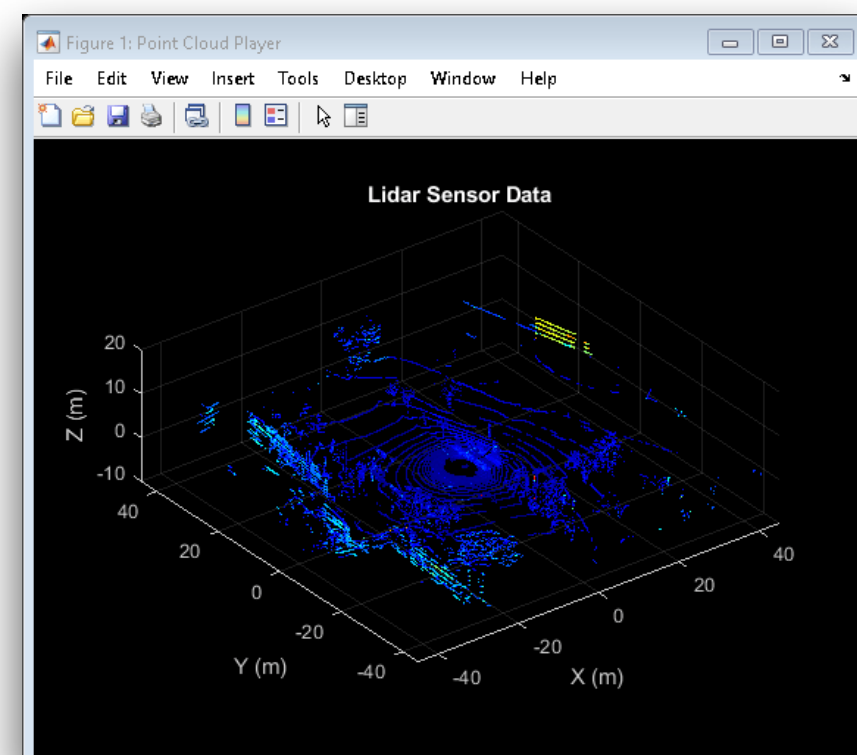
LIDAR

DATA SAMPLING INSTRUMENTATION

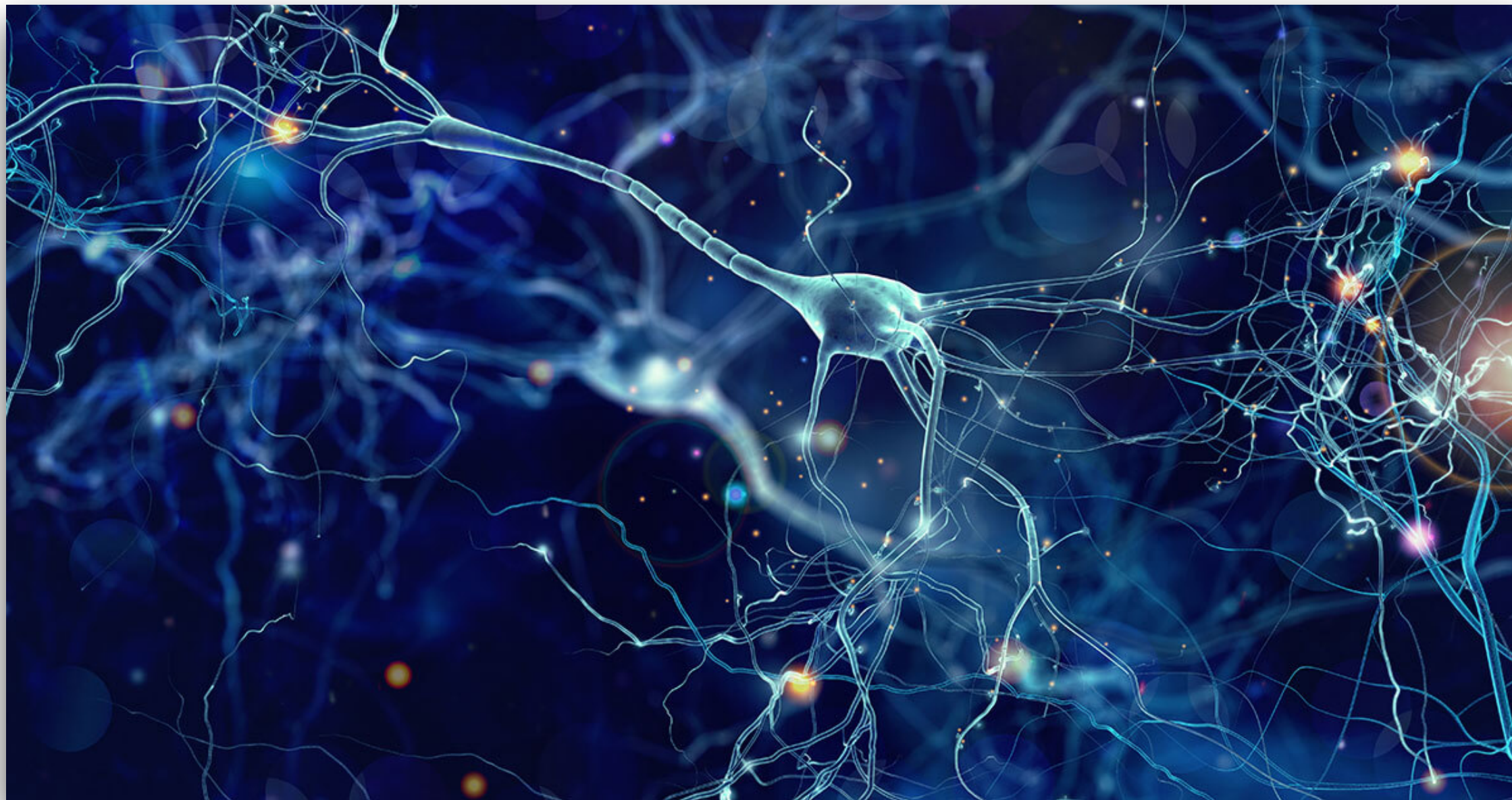


An interesting solution for **non-invasive and reliable data collection** is the **LiDar sensor**, which is able to capture not only high-frequency **images** and **geometries** but also **depth information**.

(Completely similar to the sensors used for autonomous driving)



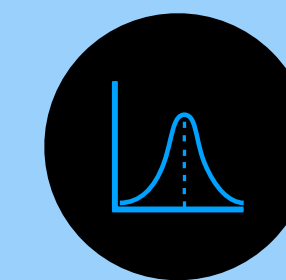
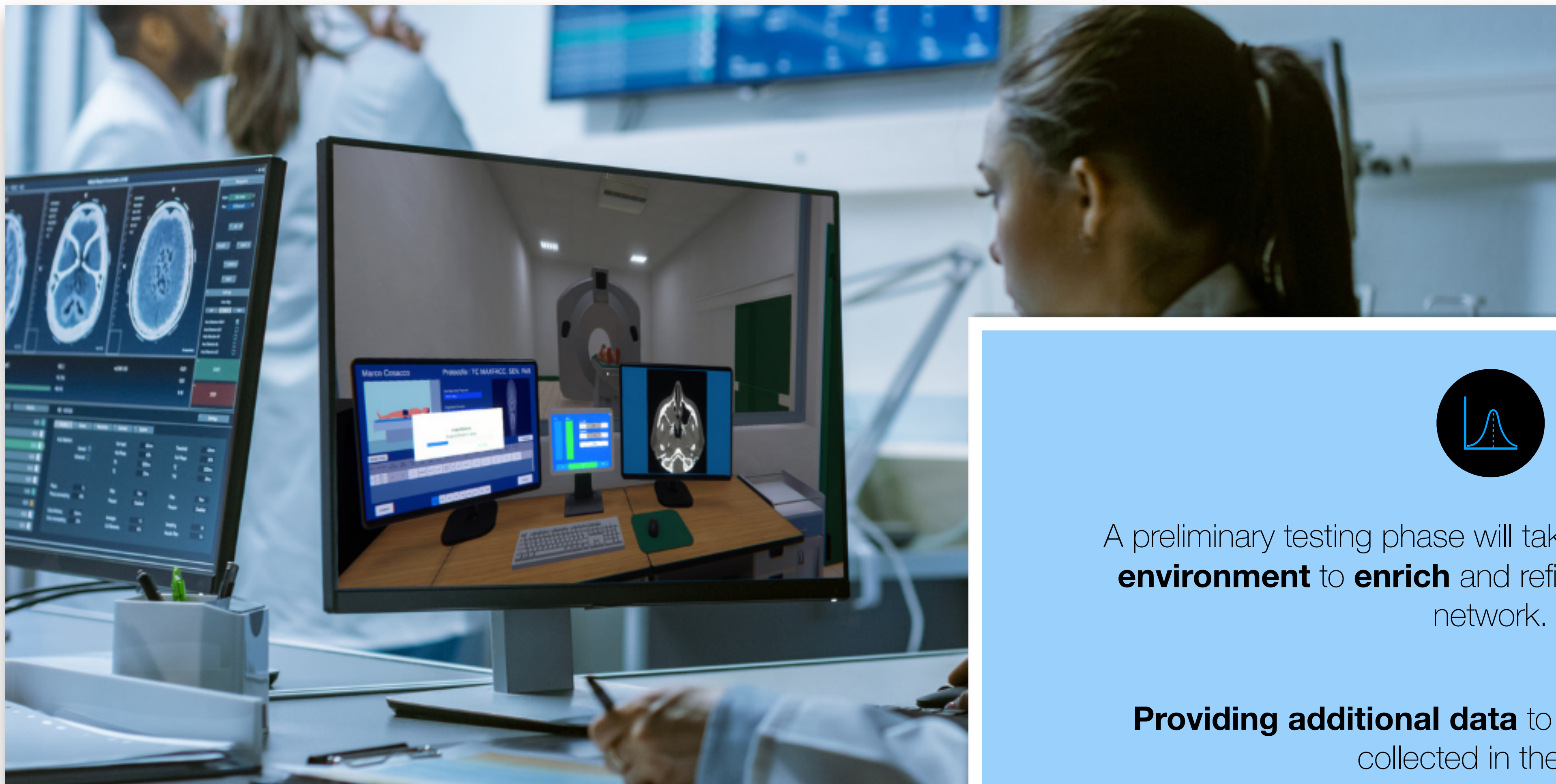
LEARNING STAGE



The learning and training phase of the neural network consists in an iterative process in which a **flow of data in and out of the network takes place**.

Each cycle of incoming data is processed through algorithms based on the concept of **Deep Learning**, made possible by the **multilayer architecture** adopted, providing an output that will be processed again.

TEST IN SIMULATED ENVIRONMENT



A preliminary testing phase will take place in a **simulated environment** to **enrich** and refine the Fourier.AI neural network.

Providing additional data to complement the data collected in the OR.

ASSISTANCE IN THE OPERATING ROOM

PARTIAL APPLICATION OF THE SYSTEM

After the first phase of learning and refining
Fourier.AI it is now possible to use the system as
an **assistant for surgery**.

In this way, there will still be **no direct intervention** by artificial intelligence but at the same time it will have the ability to **deal with emergency and unexpected situations**, consequently learning.

ACADEMIC USE

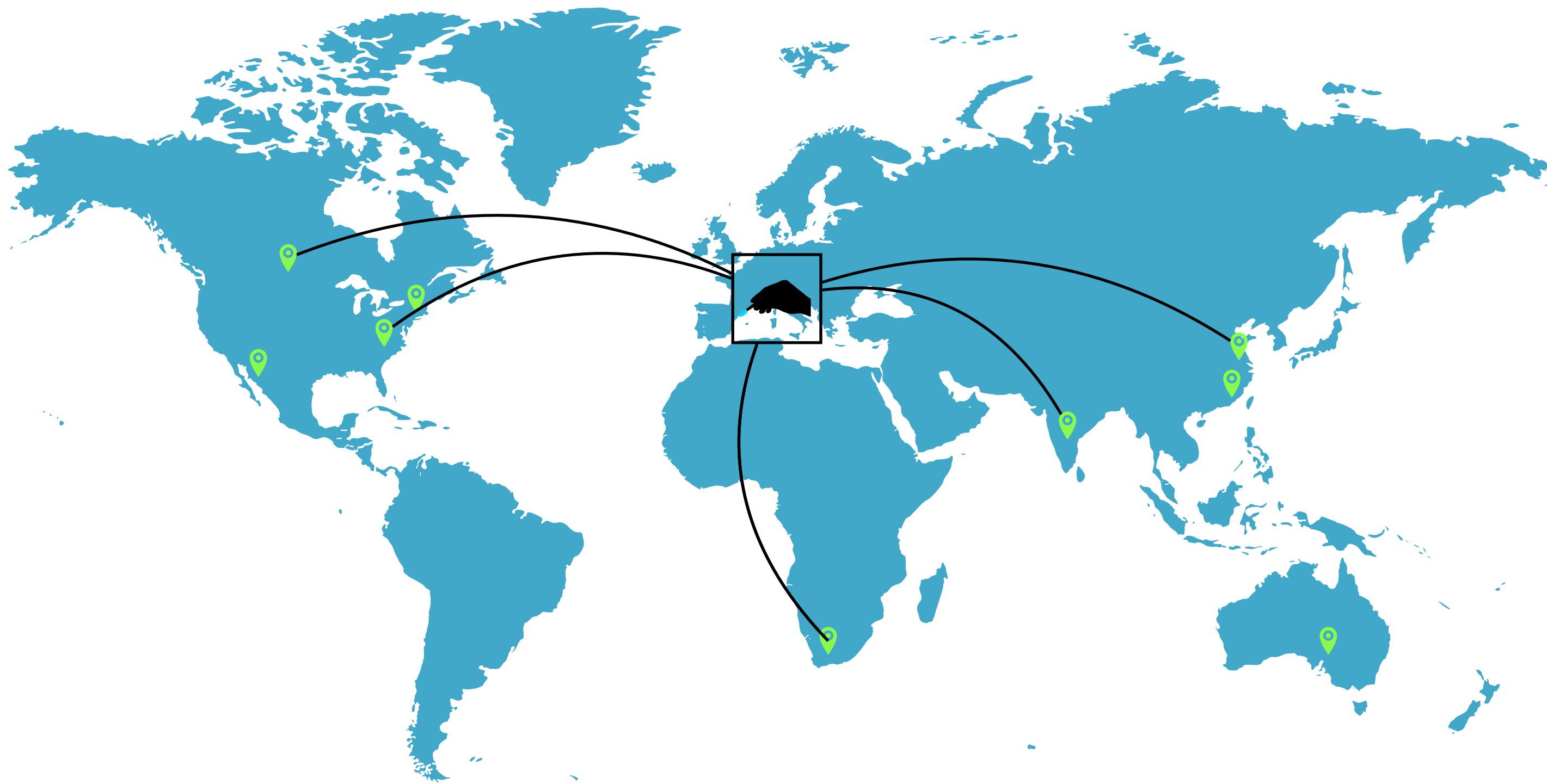
PARTIAL APPLICATION OF THE SYSTEM



It could provide a **powerful tool** for trainees and **students** by integrating it with appropriate **software based on Fourier.AI.**

NETWORKING

PARTIAL APPLICATION OF THE SYSTEM



Adoption of Fourier.AI by different **research poles** would contribute to the **decentralized development** of the project, greatly increasing its **potential and probability of success**.

TOTAL IMPLEMENTATION

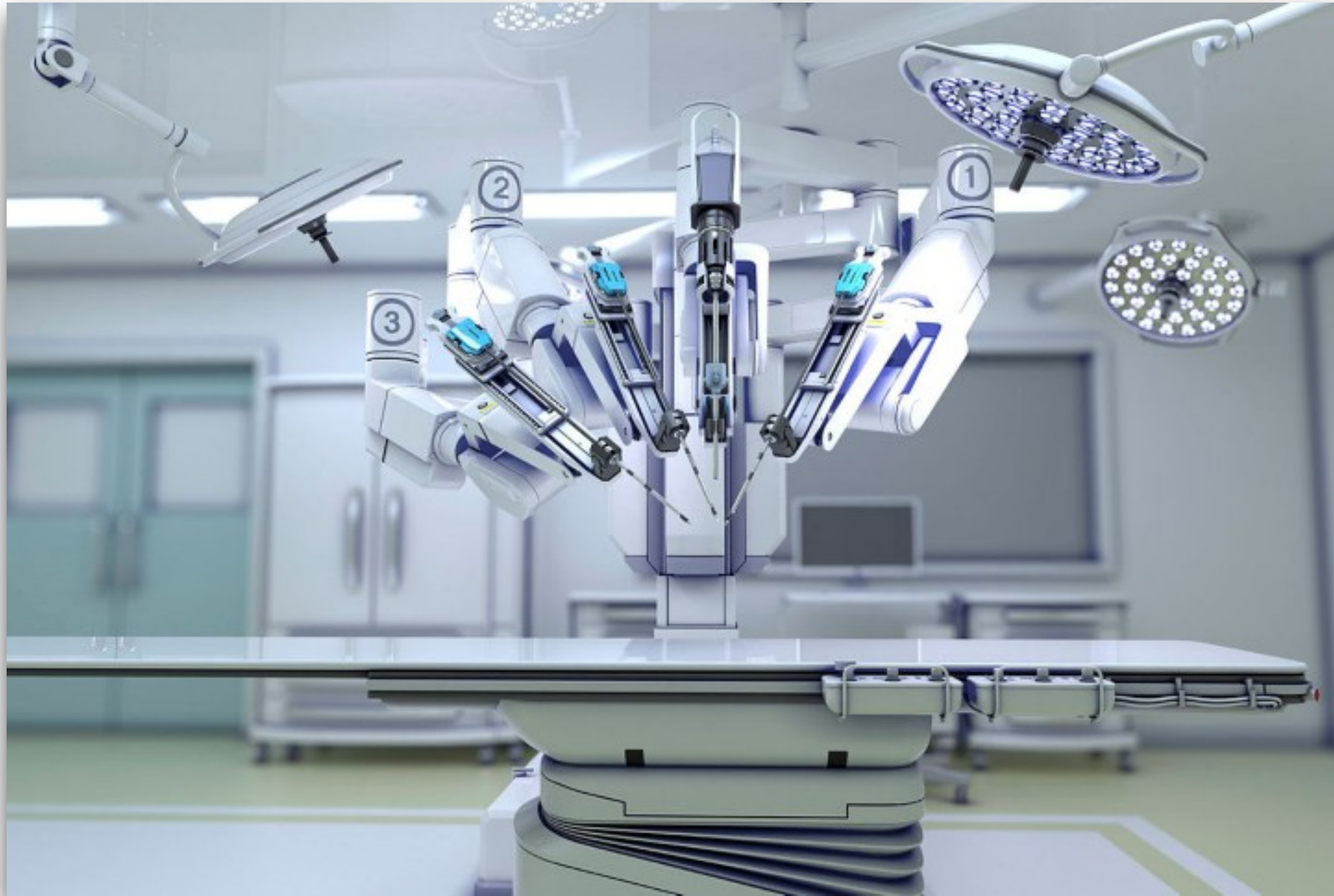
MAIN GOAL

The **total application of the Fourier.AI system** consists in being able to perform in an automatic way, accompanied only by medical **supervision**, of surgical interventions with an **accuracy** and probability of **success** close to **100%**.

Starting with **less risky and complex interventions** proceeding **gradually** to those where **human cognitive** ability alone **is not sufficient**.



SYSTEM INTEGRATION



Fourier.AI could be conveniently **interfaced** through **existing or developing systems** with **surgical automation machinery.**

POSSIBLE LENDERS OR CLIENTS



Public Institutions



Universities and research centers



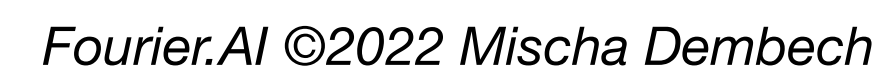
Medical Devices Companies

SOCIAL IMPACT

Having a **skilled and specialized surgeon** available in the required field is not always possible, especially in **developing or particularly poor countries**.

Fourier.AI would overcome this problem by **providing a system** capable of acting in the **most correct and safe way** for most situations where **immediate surgical intervention is required**.





FIRST YEAR EXPENSES BUDGET

Monthly Expenses		Initial Expenses	
Project Manager	4166,00 €	Administrative costs	2500,00 €
Software Engineer (x3)	3333,33 €	Materials	12000,00 €
Office Rent	1000,00 €	TOTAL	14500,00 €
Electricity + Net	300,00 €		
Accountant	90,00 €		
TOTAL	15555,99 €		
		First Year TOTAL	
		201171,88 €	

