

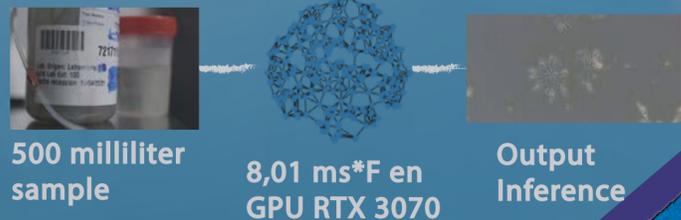
# WATER QUALITY MONITORING USING HIGH RESOLUTION MICROSCOPIC IMAGES AND MACHINE LEARNING



\*Winning project of the Hackathon of Siemens Germany AI@Sustainability 2020 and Chile Hidroingeniería por el Agua.  
\*\*Project presented at the ROBOTICS21 congress in Paris, France March 24 and GTC Nvidia April 26.

## RESULTS

- > Using 515,000 416x416 px images in a 70/20/10 ratio, I achieved an accuracy of 85.76% and a sensitivity of 82.14% in a range of 45 FPS.
- > Analysis results in 2.49.

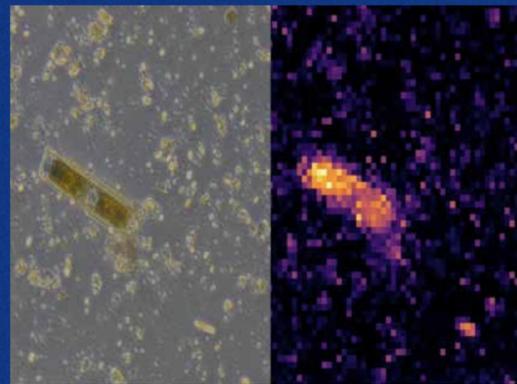


## ML architecture for Microbiology

> A tri-modular hybrid architecture was designed that contemplates a GRU-RNN sequential model to discriminate microorganisms from particles. A 3D-CNN spatial model is then used to estimate the superfamily and classify the microorganism. Finally, it goes through a static model that identifies and transforms (transformed vision) the results of the previous models to obtain a digital image of the microorganism based on its microbial metabolism.

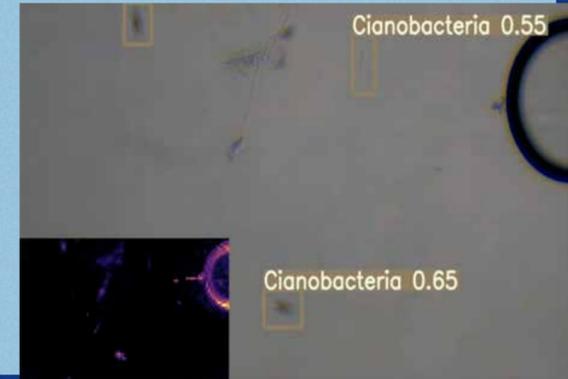
## MOTIVATION

- > Microbiological analysis in water is very expensive due to the cost of time and use of substances for its identification.
- > Environmental microbiology is the only area that has not had a major innovation for 40 years in Chile and generates the highest number of deaths in countries without drinking water treatment.



Identification of Pathogenic Cyanobacteria (*Nitzschia dalmatica*).

Count of N° Cel/ml to obtain % biovolume of Cyanobacteria WHO 6



## Machine Learning Selection

- > Due to the versatility of microbiological detection, an architecture with "federated learning" was used because it has the ability to retrain using the knowledge of other system deployed in other geographic sectors.
- > The results show that the precision and sensitivity of the neural network do not vary significantly between federated and traditional learning.

