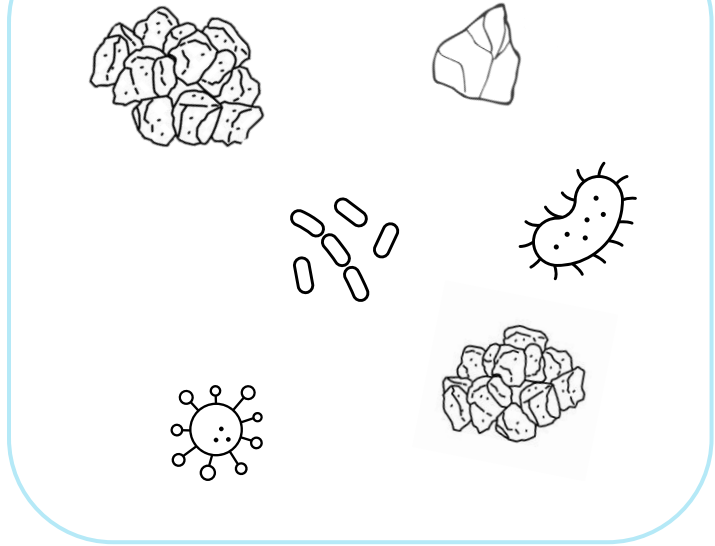
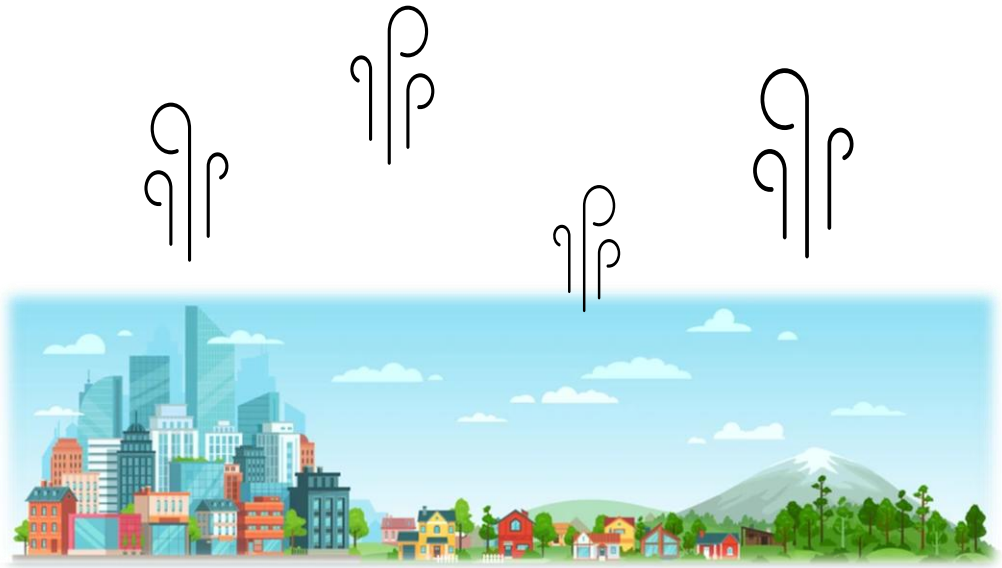
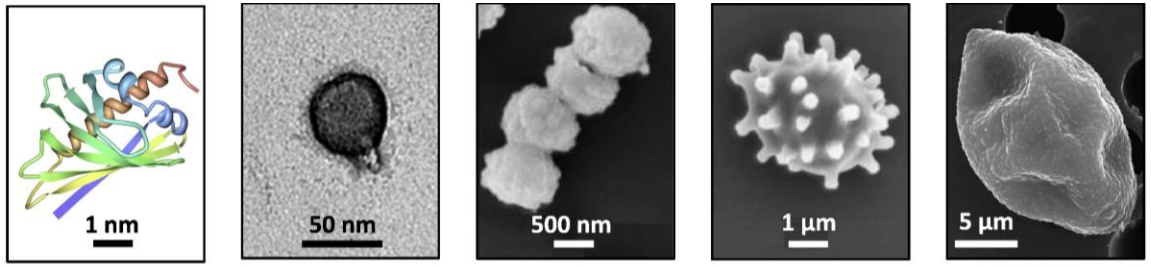
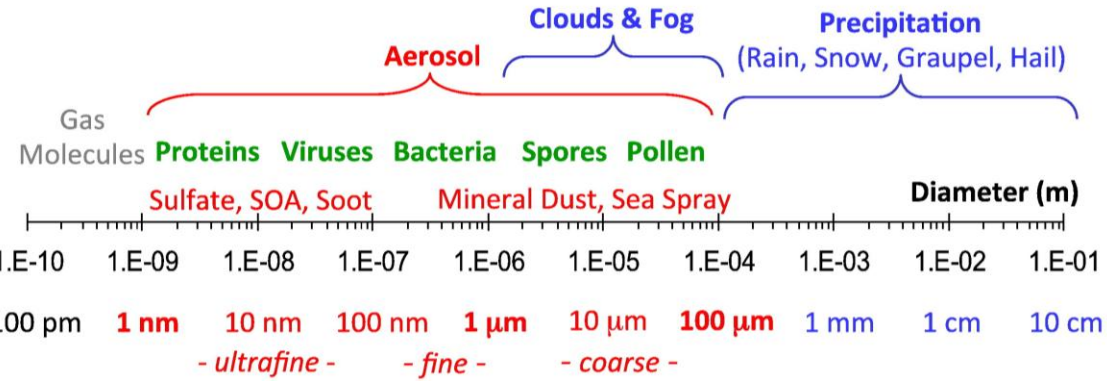
Contexte scientifique

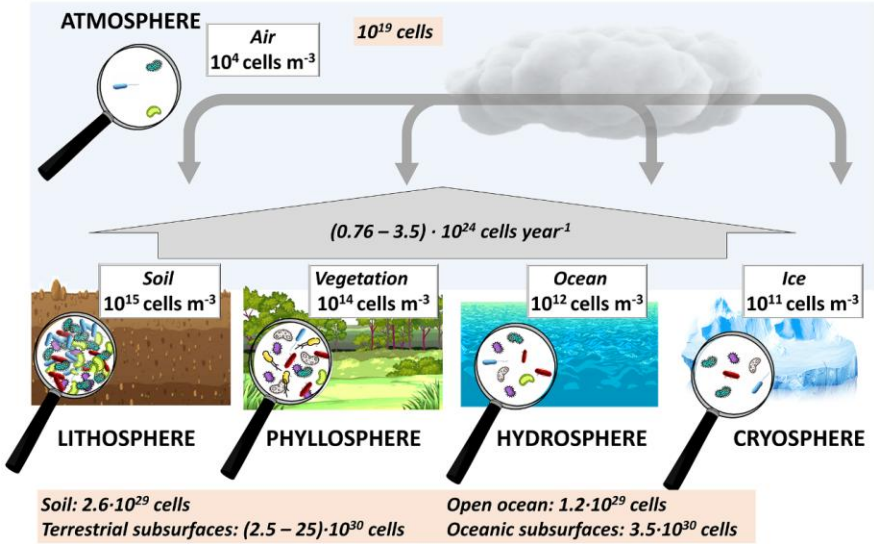






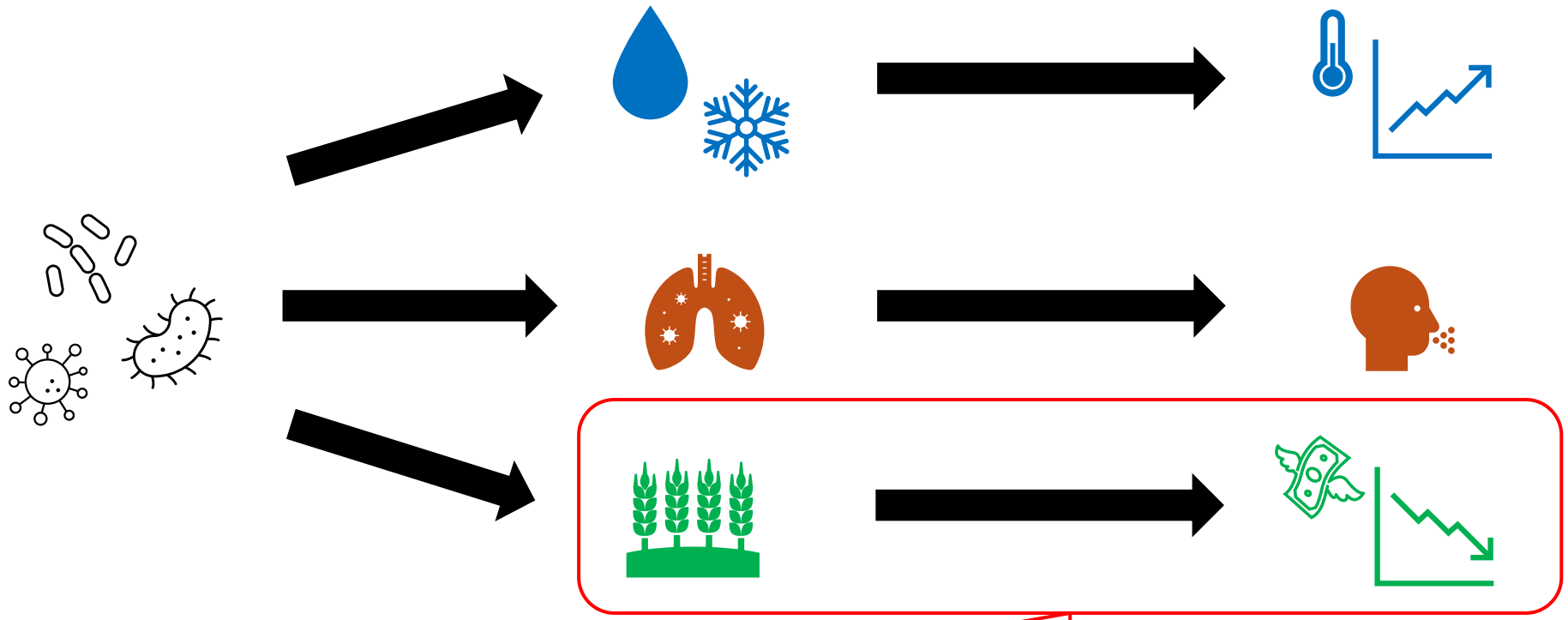


Source: Fröhlich-Nowoisky et al. (2016)



Source: Ervens et al. (2025)

Pourquoi étudie-t-on les bioaérosols ?



Rouille brune de blé (*Puccinia triticina*)

(haut) *Alternaria linariae*
(bas) Symptômes sur plant de tomate

Mesures In Situ:
historique des méthodes d'observation

XIXème siècle — Premières observations

Carnelley et al., 1887
Pasteur 1862

1950's — Méthodes manuelles: Hirst trap

Hirst, 1952

1980's — 1ère utilisation de la fluorescence

Pinnick et al., 1995

2000's — Surveillance en temps réel

WIBS (Healy et al., 2014)
BAA500 (Oteros et al., 2020)
Rapid-E (Šaulienė et al., 2019)
Poleno (Sauvageat et al., 2020)

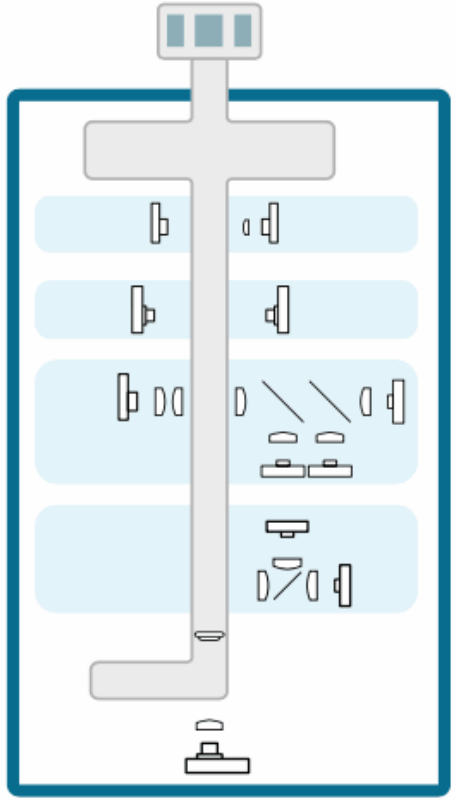
Aujourd'hui — Implémentation de l'IA

Erb et al., 2024

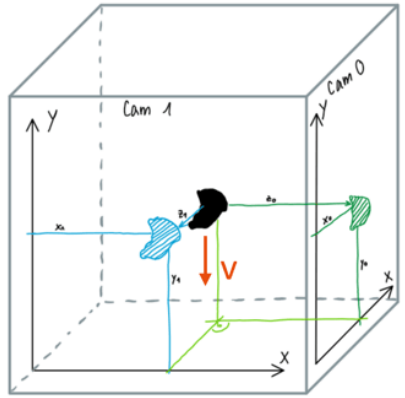
Mesures In Situ : Swisens Poleno Jupiter

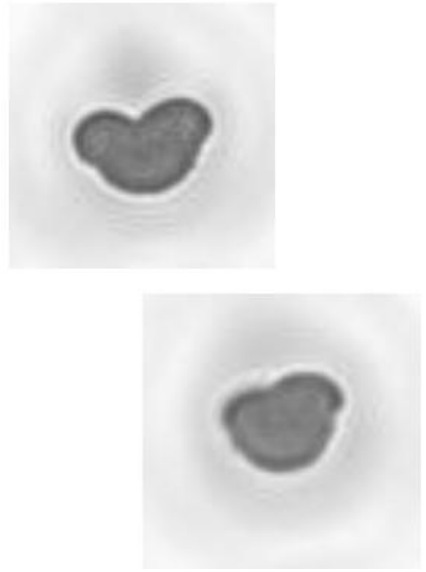
Grenoble, 3 février 2025

Puy-de-Dôme, 6 février 2025

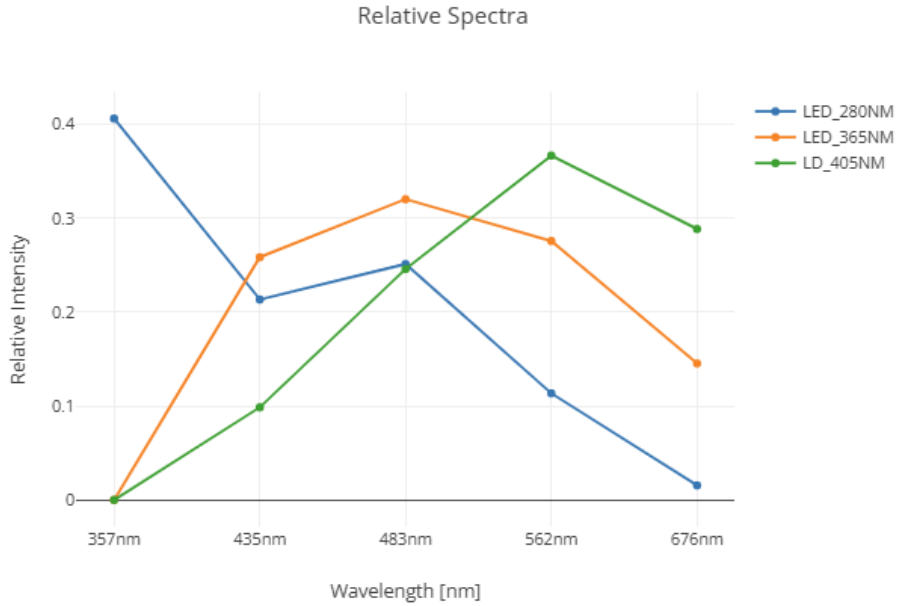


Holographie:





Fluorescence:

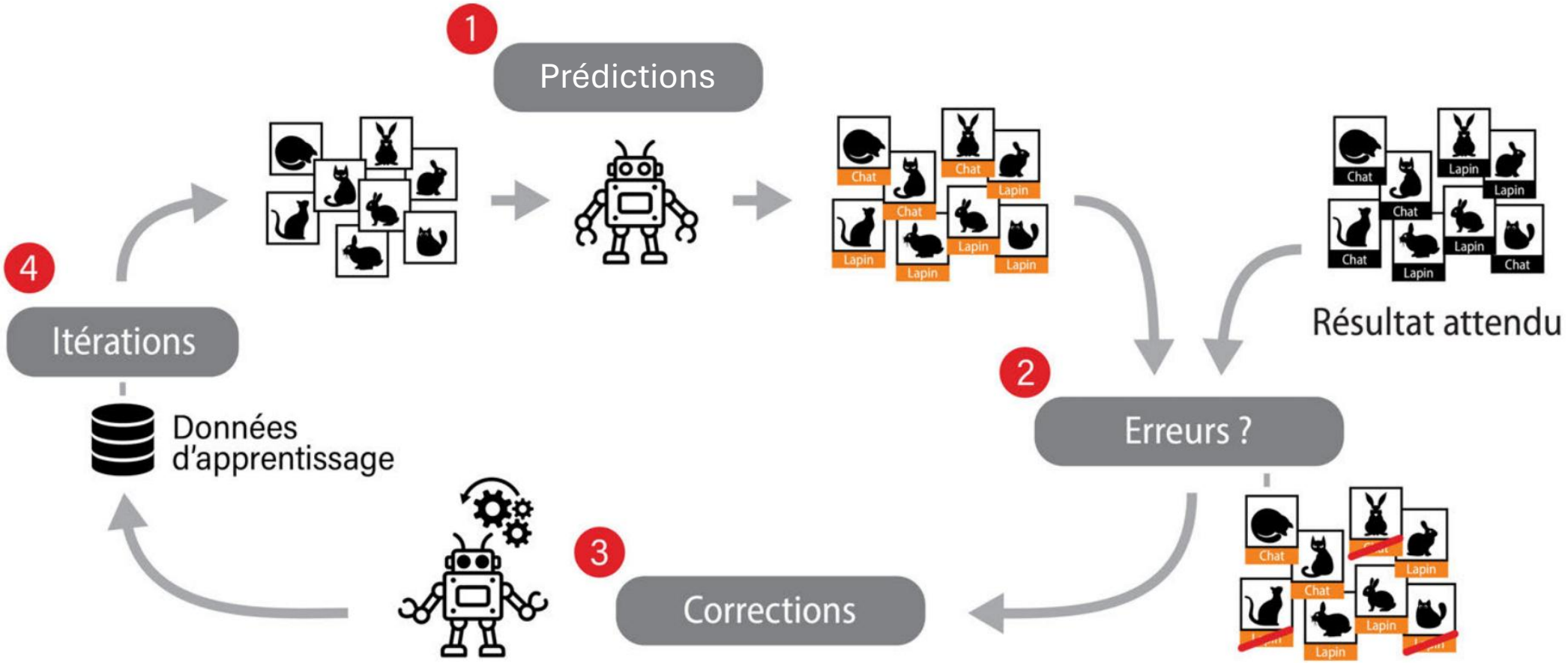


Grand volume de données à traiter

→ Le Machine Learning peut aider à traiter ce problème

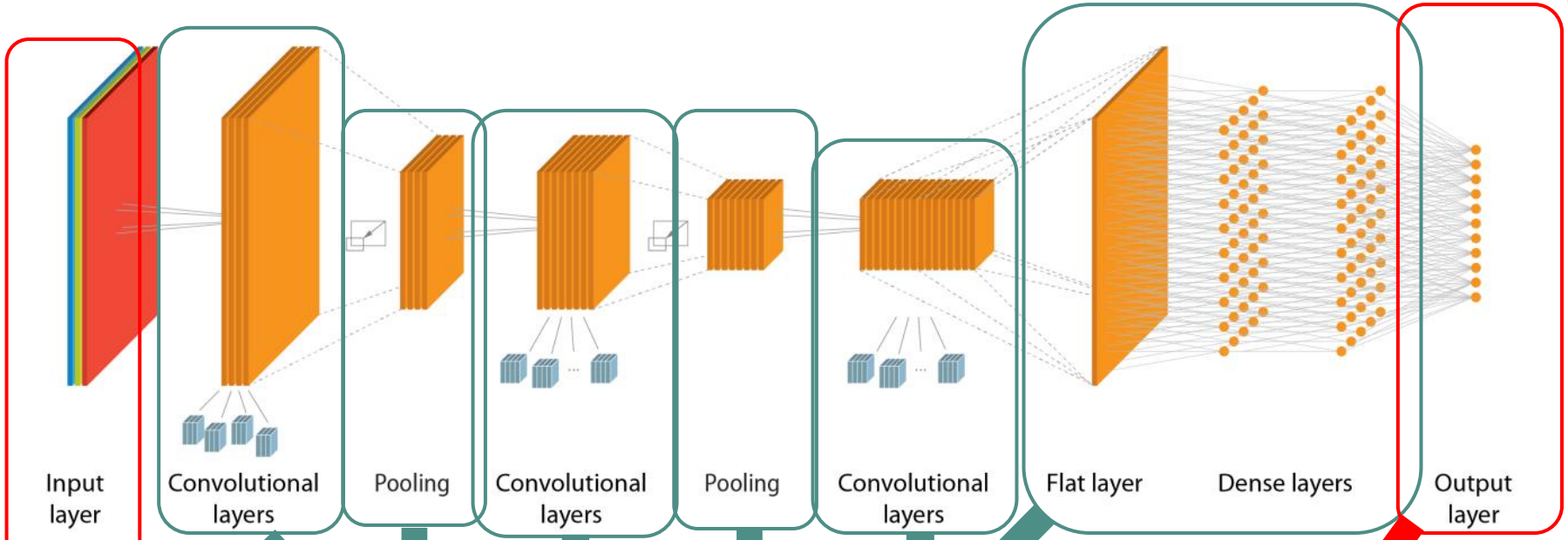
Sources :
- Sauvageat et al. 2020
- Erb et al. 2024
- Swisspoleno Jupiter fonctionnement: https://kb.swisens.ch/how-does-swisenspoleno-jupiter-work

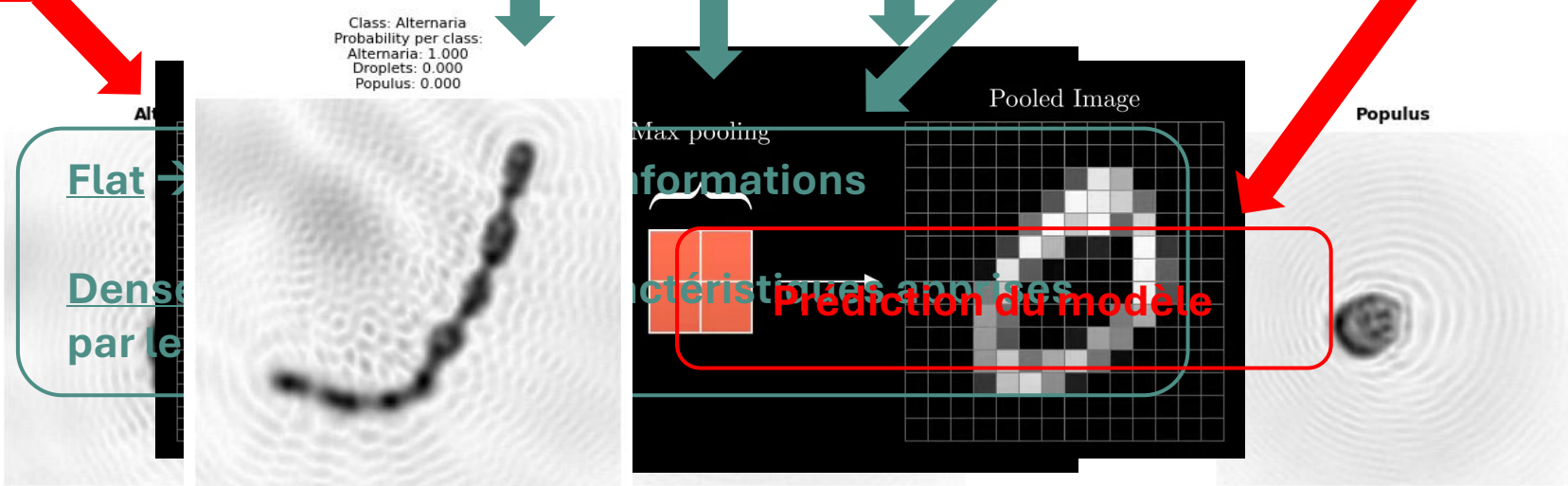
Réseau de neurones: époques d'apprentissage



Source:
www.fidle.cnrs.fr

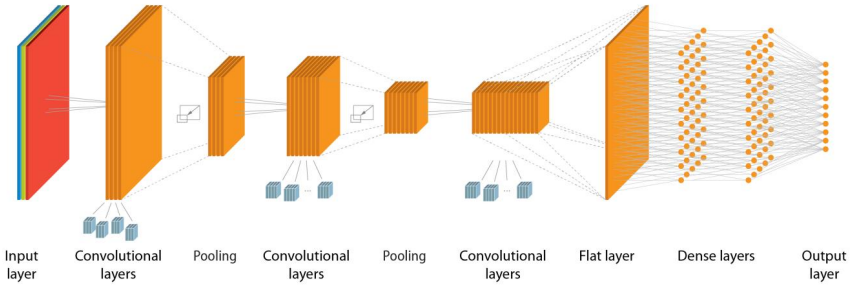
Détail d'une époque



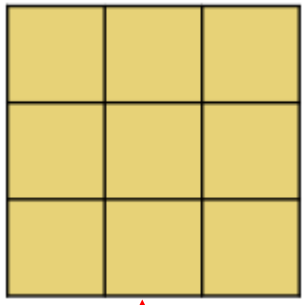


Sources:
www.fidle.cnrs.fr
https://www.youtube.com/watch?v=ip2HYPC_T9Q

Premier cas d'étude:
Apprentissage sur des images simples



Kernel 3×3



Max Pooling 2×2

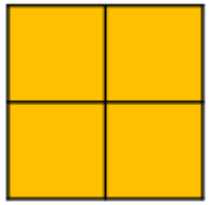
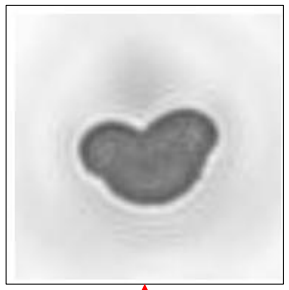


Image en entrée 200×200 pixels



5 couches convolutives

4 MaxPooling

2 Drop Out

```
model = Sequential([
    Conv2D(4, (3,3), activation='relu', input_shape=(200, 200, 1)),
    MaxPooling2D(2,2),

    Conv2D(8, (3,3), activation='relu'),
    MaxPooling2D(2,2),

    Conv2D(16, (3,3), activation='relu'),
    MaxPooling2D(2,2),

    Conv2D(32, (3,3), activation='relu'),

    Conv2D(64, (3,3), activation='relu'),
    MaxPooling2D(2,2),
    Dropout(0.3),

    Flatten(),
    Dense(1024, activation='relu'),
    Dropout(0.5),
    Dense(3, activation='softmax')
])
```

Source:
www.fidle.cnrs.fr

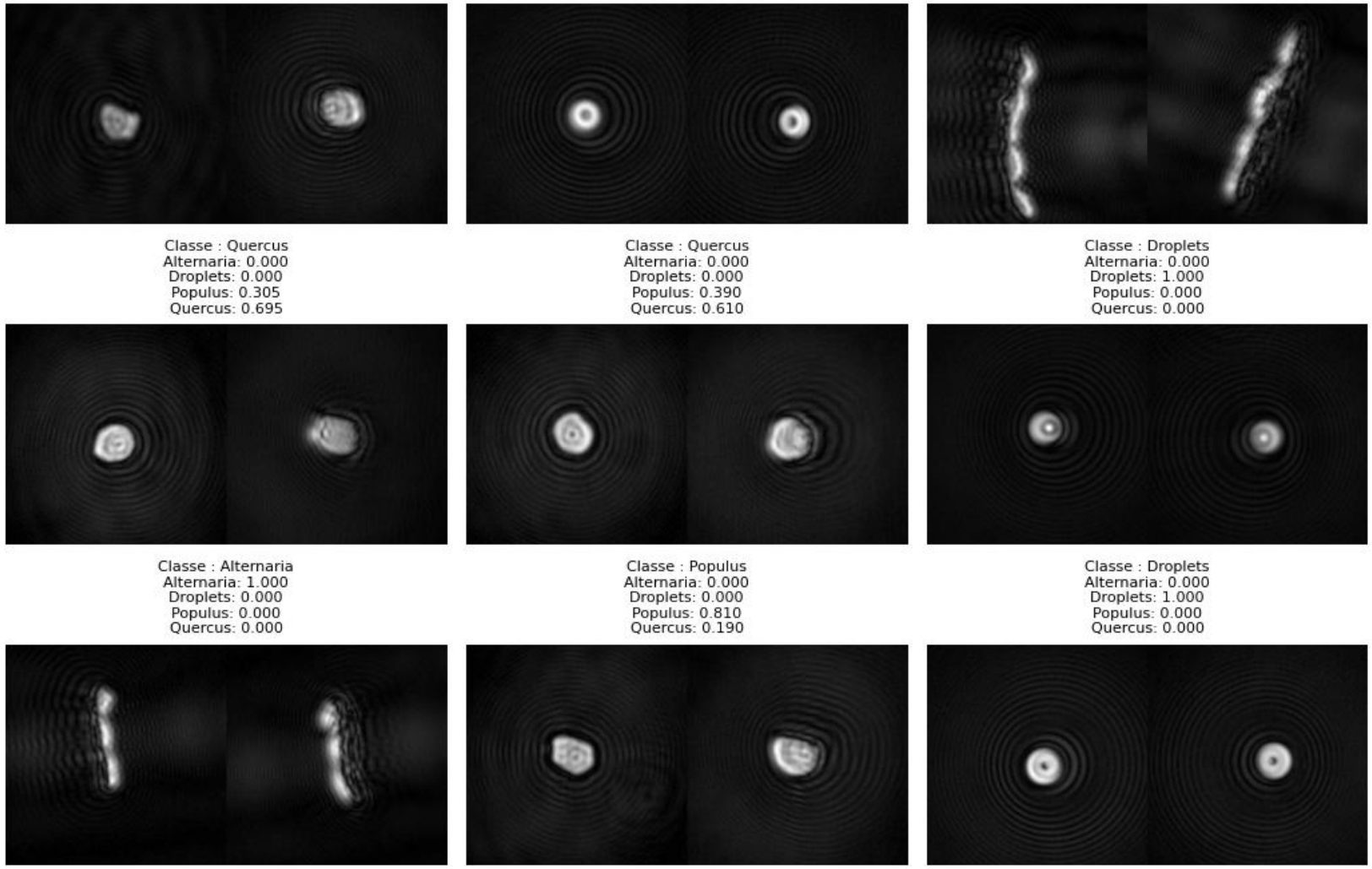
Second cas d'étude:
Apprentissage sur des paires images

Classes d'entrées:

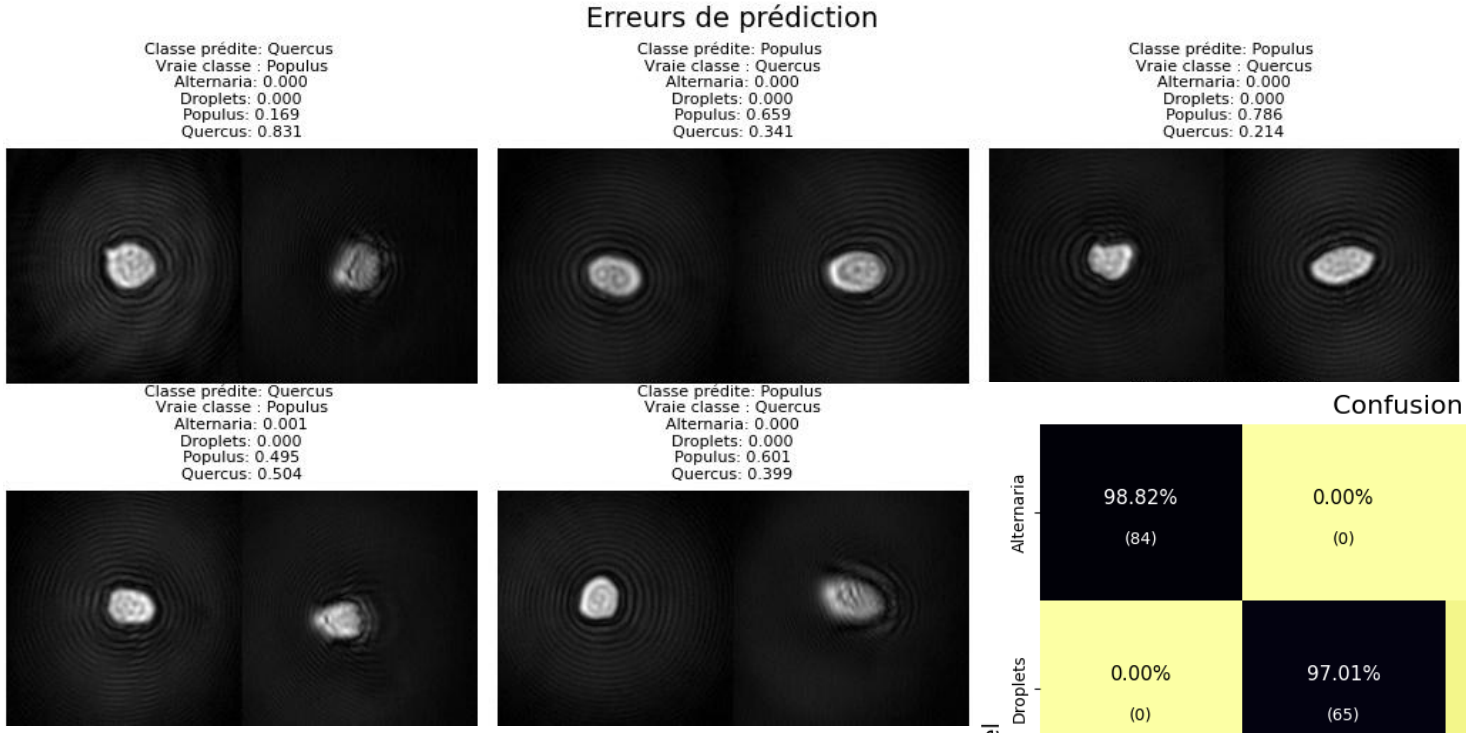
Alternaria (Spore fongique)
Droplet (Hydrométéore)
Populus (Pollen)
+ Quercus (Pollen)

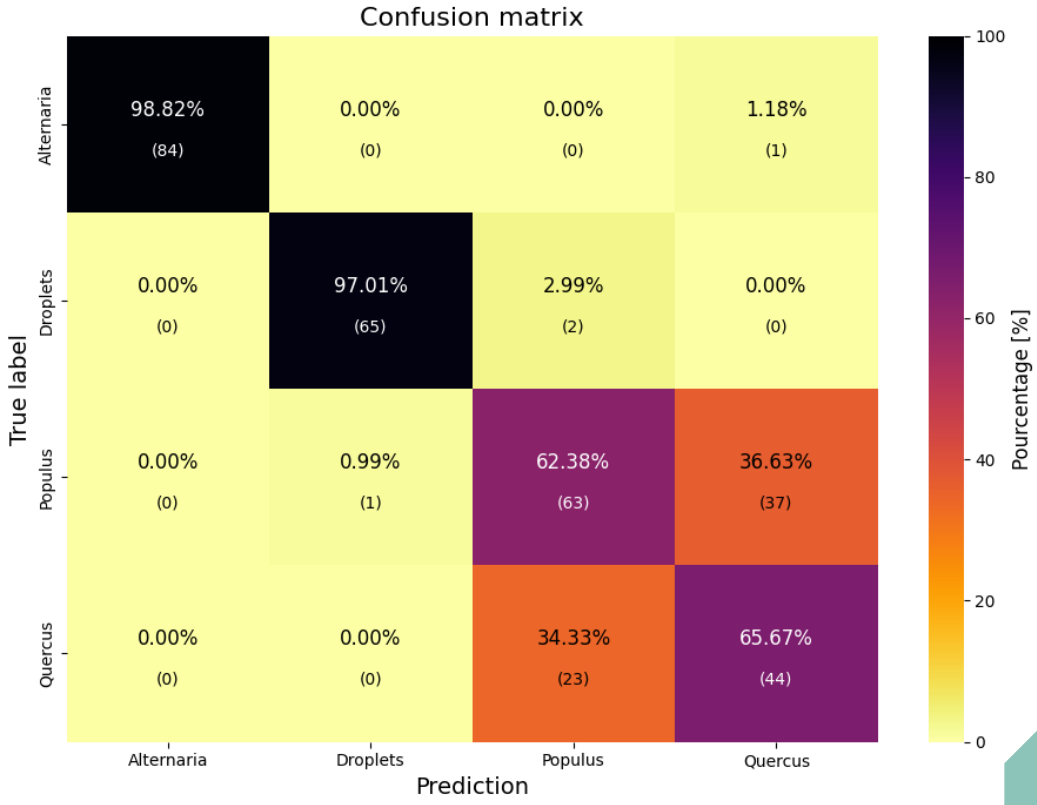
Ajout d'une 4e classe: Quercus

Bonnes prédiction



Second cas d'étude:
Apprentissage sur des paires images





Modèle CNN Swisens: