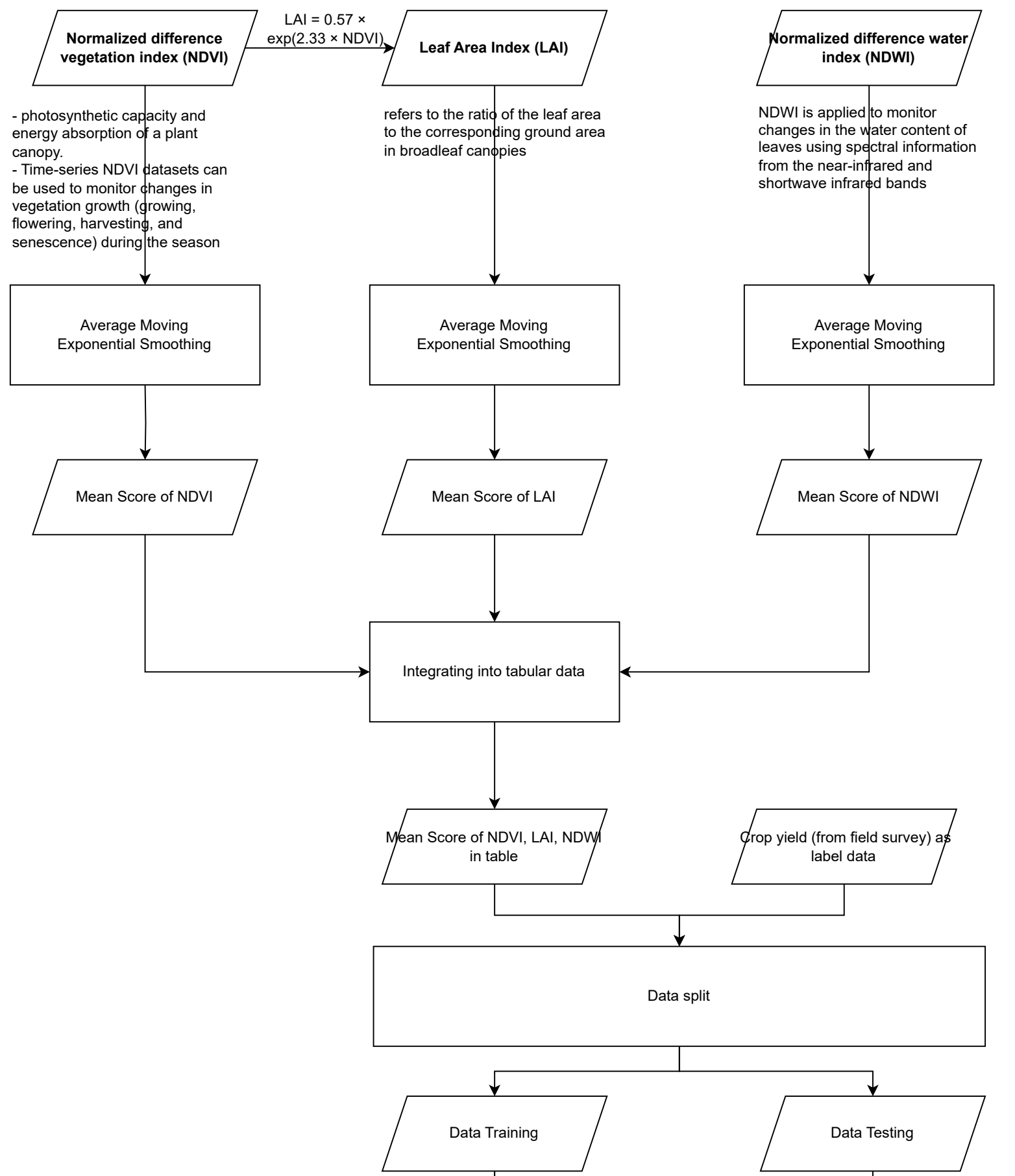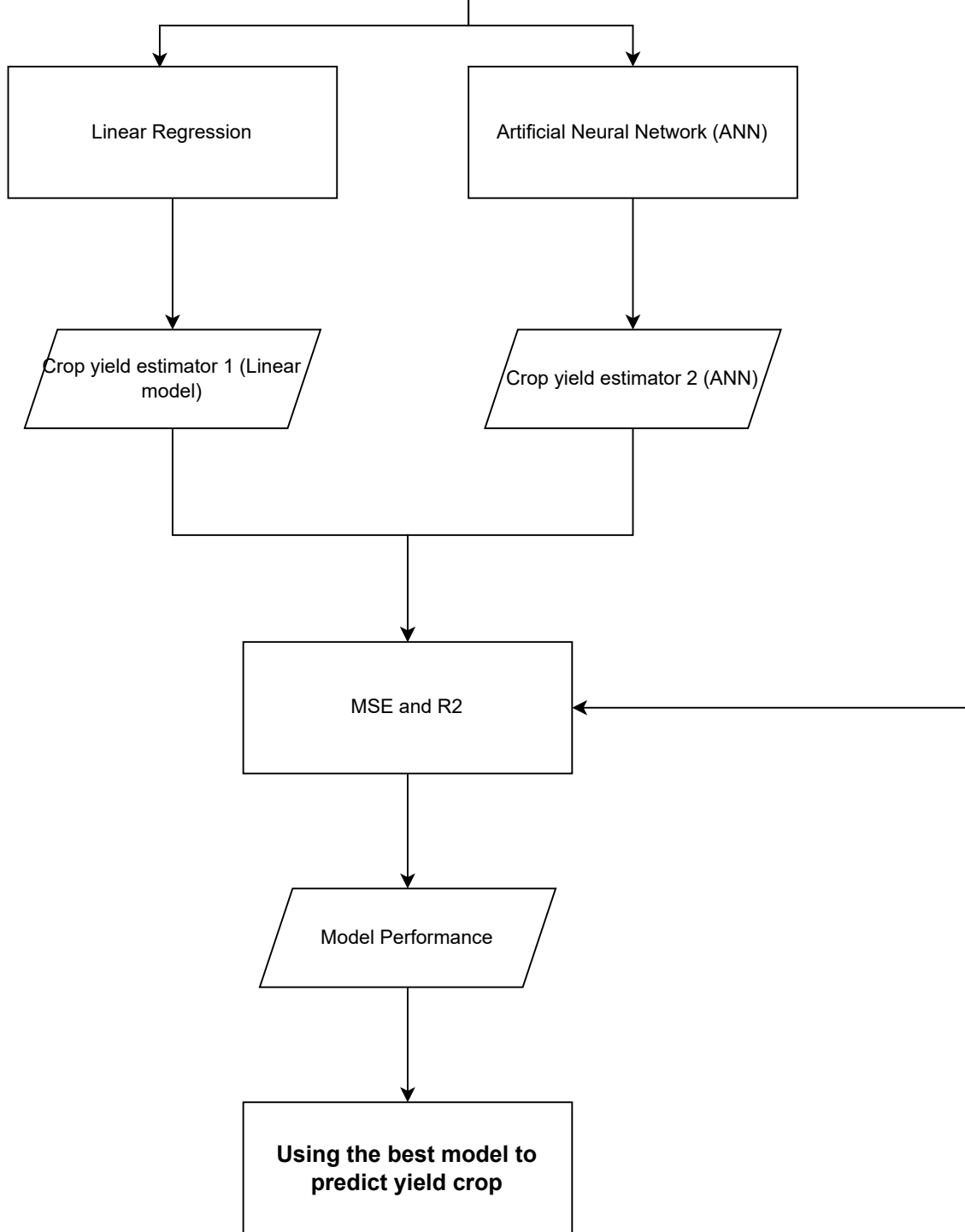# 2021 - Prediction of grape yields from time-series vegetation indices using satellite remote sensing and a machine-learning approach

The algorithm is computed by each pixel in 31 sample fields for 3 years

Normalized difference vegetation index (NDVI)

$LAI = 0.57 \times \exp(2.33 \times NDVI)$

Leaf Area Index (LAI)

Normalized difference water index (NDWI)

- photosynthetic capacity and energy absorption of a plant canopy.
- Time-series NDVI datasets can be used to monitor changes in vegetation growth (growing, flowering, harvesting, and senescence) during the season

refers to the ratio of the leaf area to the corresponding ground area in broadleaf canopies

NDWI is applied to monitor changes in the water content of leaves using spectral information from the near-infrared and shortwave infrared bands

Average Moving Exponential Smoothing

Average Moving Exponential Smoothing

Average Moving Exponential Smoothing

Mean Score of NDVI

Mean Score of LAI

Mean Score of NDWI

Integrating into tabular data

Mean Score of NDVI, LAI, NDWI in table

Crop yield (from field survey) as label data

Data split

Data Training

Data Testing

```
                    ┌─────────────────────┐              ┌──────────────────────────────────┐
                    │  Linear Regression  │              │  Artificial Neural Network (ANN) │
                    └─────────────────────┘              └──────────────────────────────────┘
                               │                                          │
                               ▼                                          ▼
                    ╱────────────────────╱              ╱──────────────────────────────╱
                   ╱ Crop yield estimator 1 (Linear     ╱ Crop yield estimator 2 (ANN)  ╱
                  ╱           model)         ╱          ╱                              ╱
                 ╱────────────────────────╱            ╱──────────────────────────────╱
                               │                                          │
                               └──────────────────┬───────────────────────┘
                                                  ▼
                                        ┌──────────────────┐
                                        │    MSE and R2    │◄──────────
                                        └──────────────────┘
                                                  │
                                                  ▼
                                    ╱──────────────────────────╱
                                   ╱    Model Performance      ╱
                                  ╱──────────────────────────╱
                                                  │
                                                  ▼
                                        ┌──────────────────────┐
                                        │ **Using the best model to**
                                        │ **predict yield crop**    │
                                        └──────────────────────┘
```

Findings:
1. The crop discussed in this paper is grape. What kind of crop that we want to predict? is it only one or multiple crop?
2. If we want to do multiple crop estimation, how can we do it? The object (crop and the field) in this paper is identified manually. Do we have to do image classification first before creating the estimator model?