

# ENHANCING SUGAR ADULTERATION DETECTION IN CLEAR APPLE JUICE USING LASER LIGHT BACKSCATTERING IMAGING: COMPARING TRANSMISSION AND TRANSFLECTION MODES

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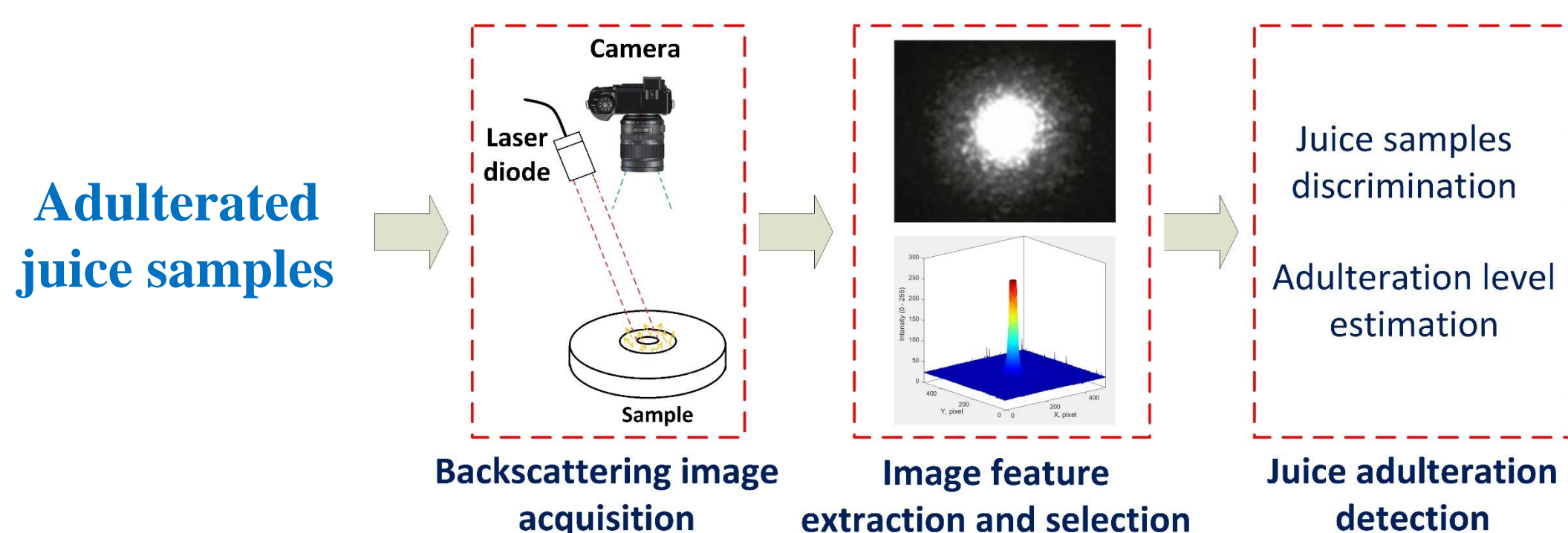
## 1. Introduction



Adding sugar to 100% fruit juice is against the law, especially in the EU.

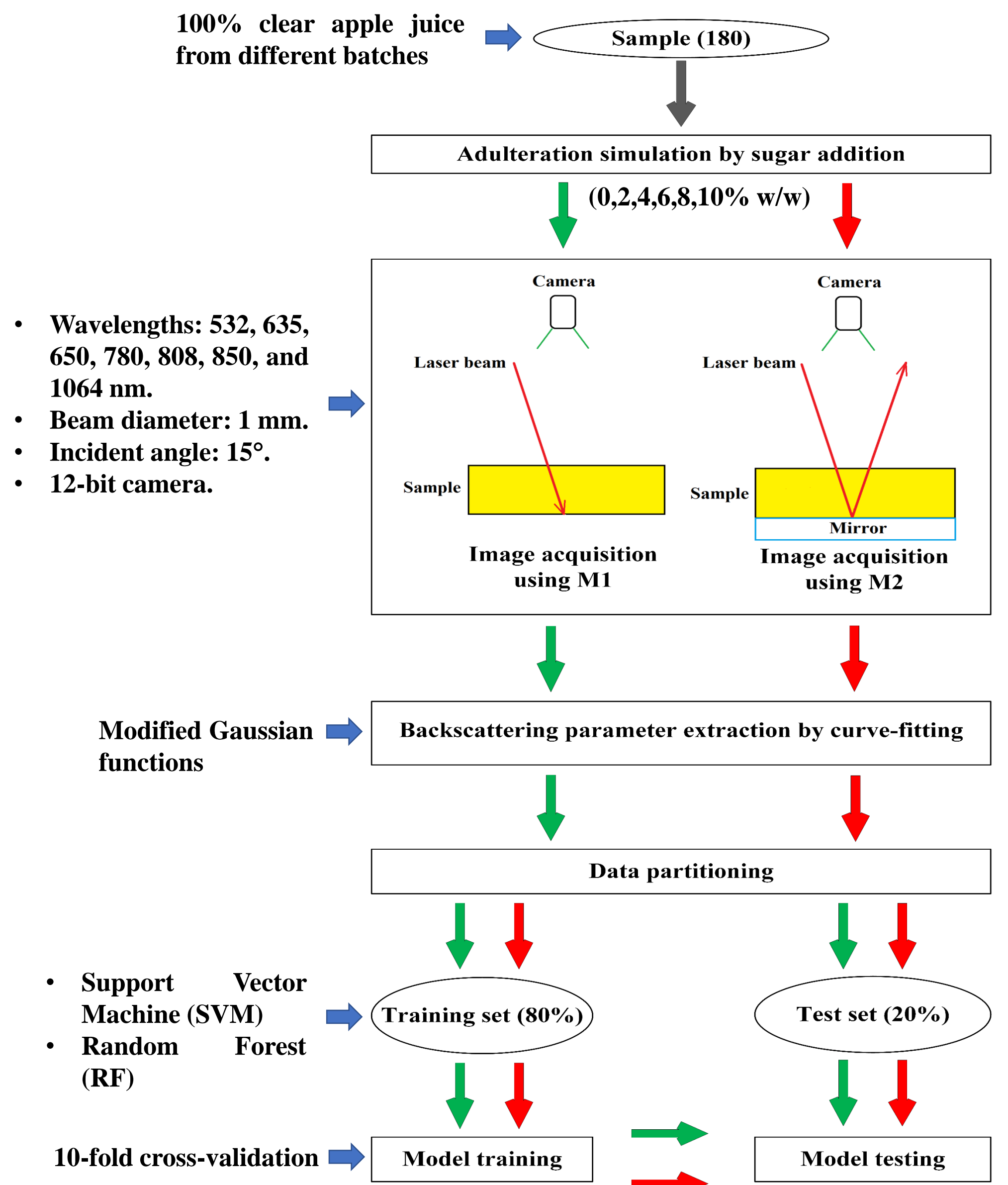


Laser light backscattering imaging (LLBI) combined with multivariate algorithms is a promising approach to detect adulteration in fruit juices.



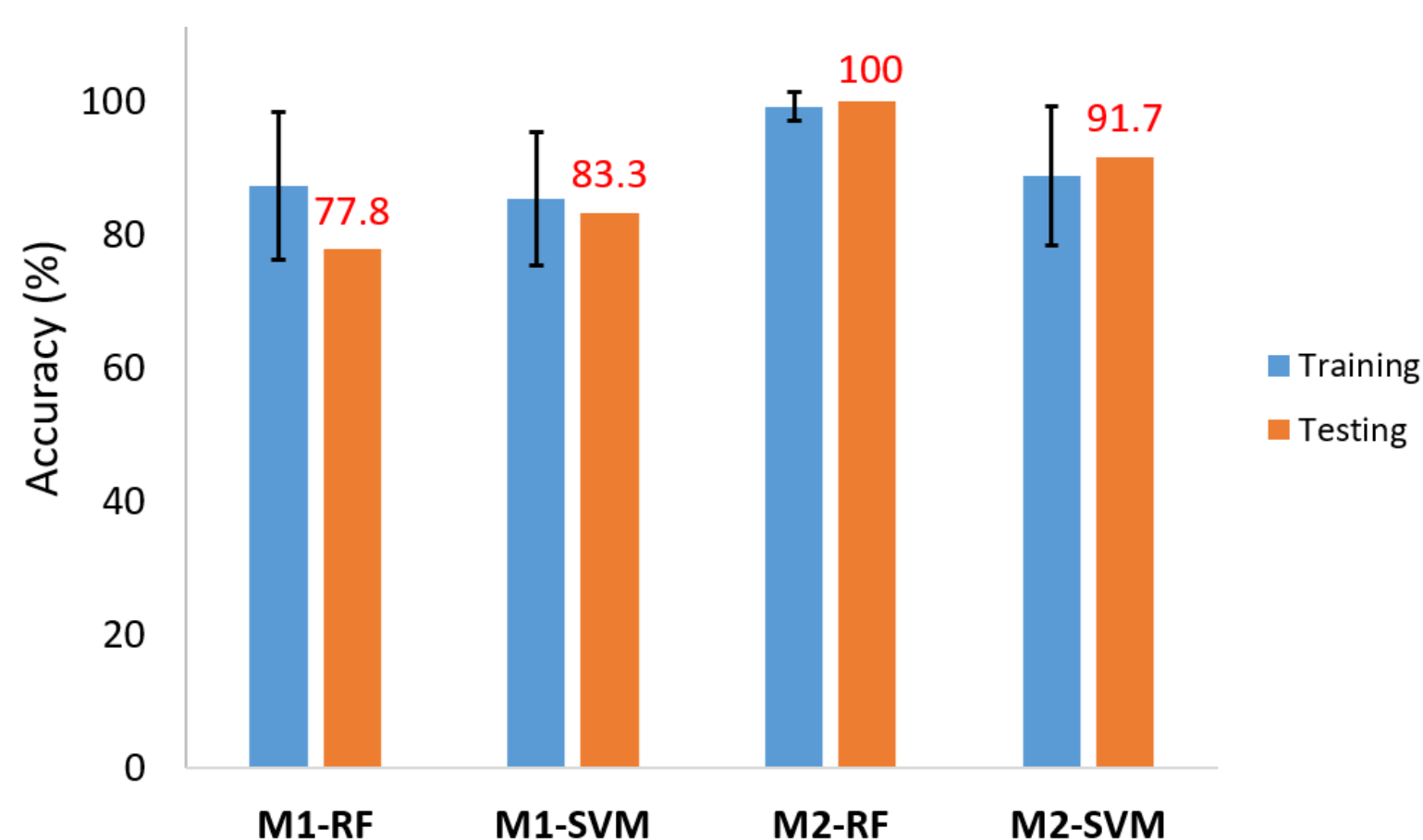
The objective of this work was to assess and compare the performance of LLBI in transmission (M1) and transfection (M2) modes for detecting cane sugar adulteration in clear apple juice.

## 2. Materials and methods



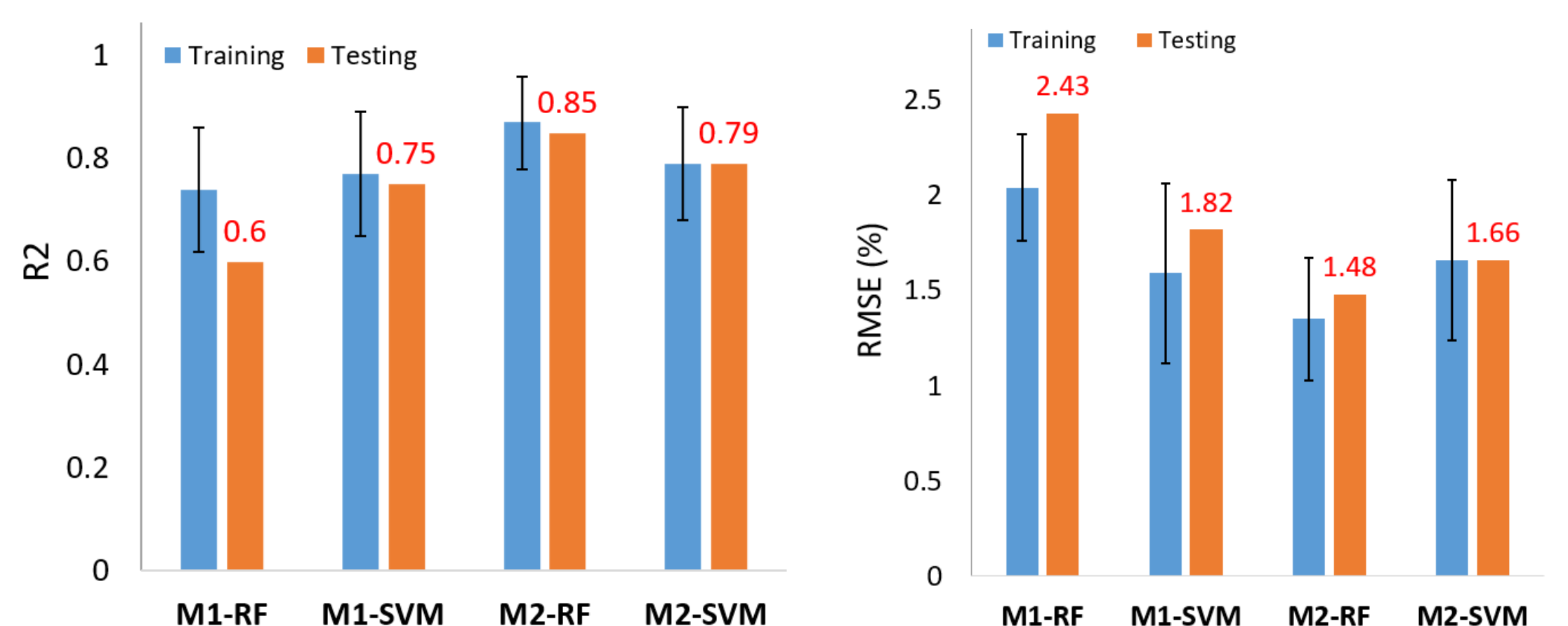
## 3. Results

### 3.1. Discrimination of samples based on adulteration level



Classification performance was evaluated using overall accuracy. The combination of M2 and RF produced the highest classification accuracy in training and testing.

### 3.2. Estimation of adulteration level



Regression performance was assessed based on coefficient of determination ( $R^2$ ) and root mean squared error (RMSE). Among the investigated models, the RF model with M2 features achieved the highest  $R^2$  and the lowest RMSE in training and testing.

## 4. Conclusions

Based on the obtained results, the proposed technique is capable of detecting sugar addition in clear apple juice. Transfection (M2) improved the model accuracy compared to transmission (M1). Random Forest (RF) outperformed Support Vector Machine (SVM) in both classification and regression. The combination of M2 and RF is suggested in this work. Future work should focus on extending the sample size and broadening the use of the technique to other fruit juice types.