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Quantitative property-acceptance relationship analysis:
predicting consumer acceptance for sensory quality control of foods

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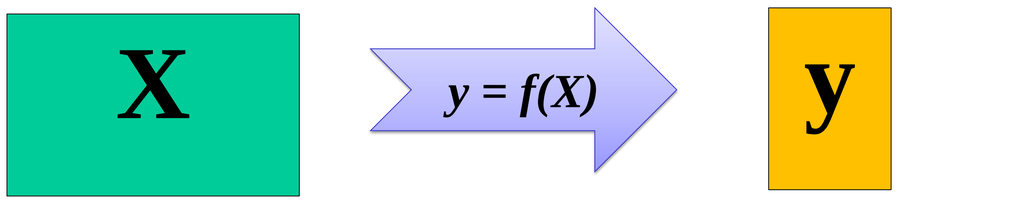
INTRODUCTION

Quantitative structure-activity relationship (QSAR)

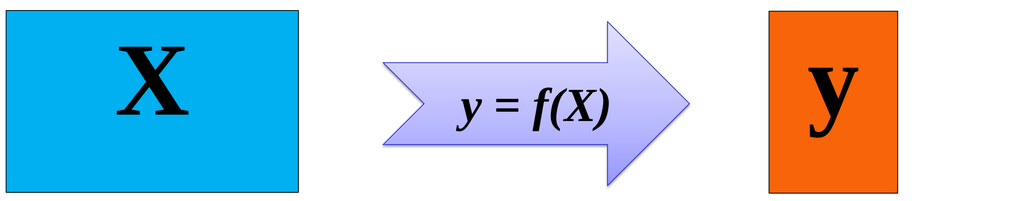


molecular parameters *biological activity*

The well-established QSAR method summarizes a relationship between chemical structures and biological activity, and then QSAR models predict the activities of new chemicals. It is widely used in drug development.

A SIMILAR IDEA !

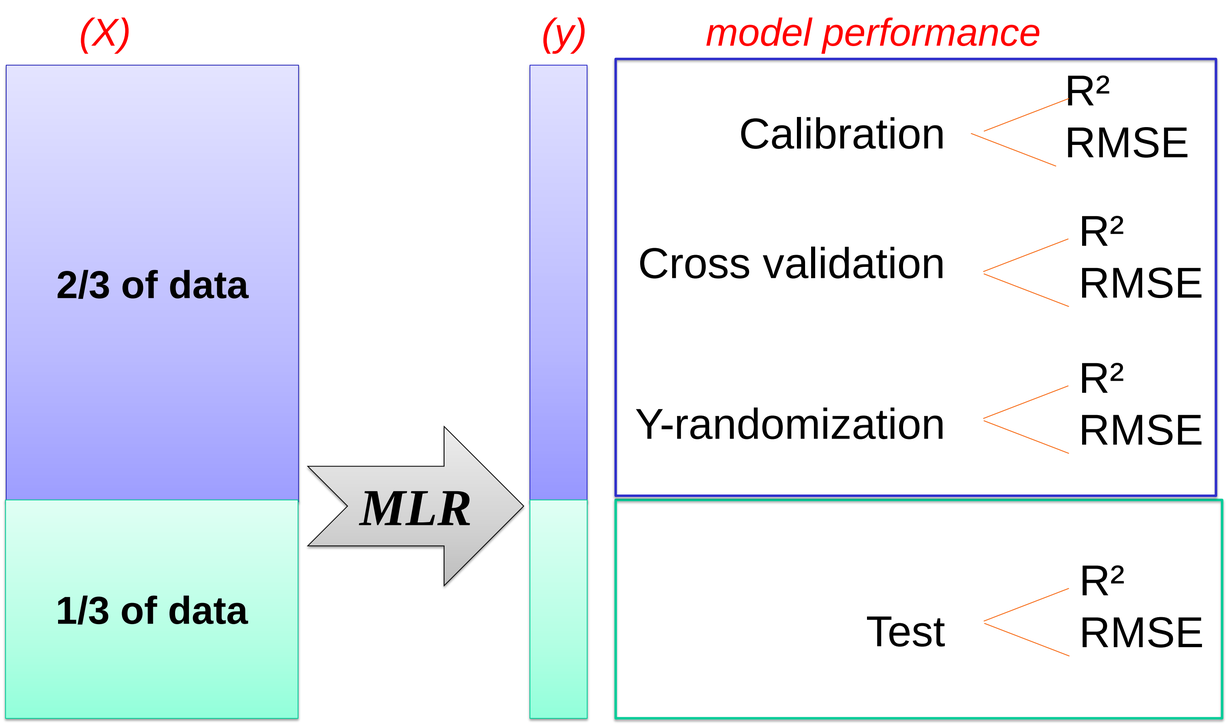
Quantitative property-acceptance relationship (QPAR)



food parameters *consumer liking*

QPAR method summarizes a relationship between food properties and consumer liking, and then QPAR models predict the consumer liking of new food samples. It is useful for sensory quality control.

EXPERIMENTAL



$$R^2 = 1 - \sum (y_i - \hat{y}_i)^2 / \sum (y - \hat{y})^2 \qquad RMSE = \sqrt{\sum (y_i - \hat{y}_i)^2 / n}$$

Data sets		
Product	***X***	***Y***
French bread †	L^*_{ct}, L^*_{cb}, a^*_{ct}, a^*_{cb}, b^*_{ct}, b^*_{cb}, weight, width, length	overall liking
Fish bread†	L^*_{ct}, L^*_{cb}, a^*_{ct}, a^*_{cb}, b^*_{ct}, b^*_{cb}, weight, moisture, bulk	overall liking
Roasted coffee	L*, a*, b*	overall liking

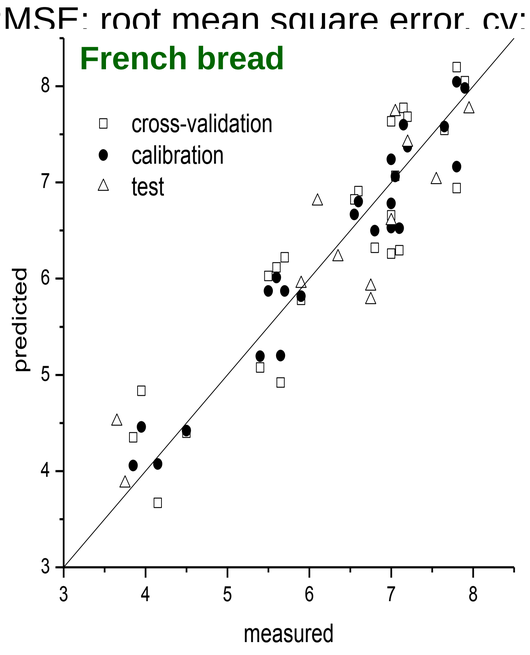
† : crust ; crumb

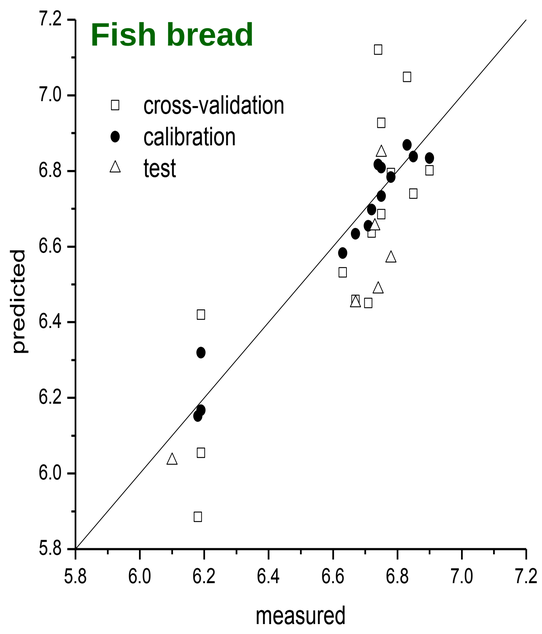
RESULTS

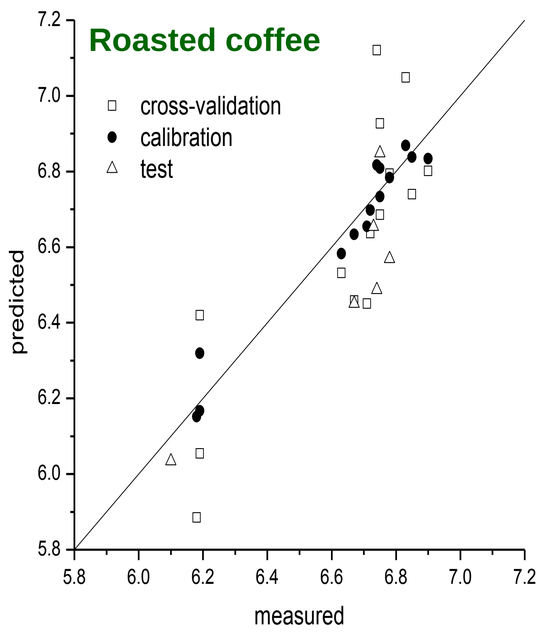
QPAR models	
Product	overall liking =
French bread	-24.26 -0.09 L^*_{ct} +0.22 L^*_{cb} -0.40 a^*_{ct} +0.22 a^*_{cb} +0.25 b^*_{ct} +0.06 b^*_{cb} +0.11 weight -1.11 width +1.29 length
Fish bread	14.12 +0.03 L^*_{ct} -0.12 L^*_{cb} -0.14 a^*_{ct} -0.07 a^*_{cb} -0.11 b^*_{ct} +0.05 b^*_{cb} +0.01 weight -0.30 moisture +1.62 bulk
Roasted coffee	11.56 -0.35 L* +0.92 a* -0.31 b*

Model performances								
Product	R^2_c	$RMSE_c$	R^2_{cv}	$RMSE_{cv}$	$R^2_{y\text{-rand}}$	$RMSE_{y\text{-rand}}$	R^2_t	$RMSE_t$
French bread	0.93	0.32	0.83	0.52	0.36	0.97	0.81	0.57
Fish bread	0.95	0.05	0.70	0.20	0.59	0.15	0.77	0.17
Roasted coffe	0.98	0.04	0.95	0.06	0.53	0.20	0.85	0.17

RMSE: root mean square error, cv: cross validation, c: calibration, t: test







CONCLUSION

Consumer acceptance can be indirectly predicted by easy and rapid physical measurements using regression models. Once built and validated, the models can be used to predict the consumer acceptance by rapid measurements on the products. This is useful for quality control in industry, allowing to rapidly access the acceptance, an important characteristic of product.