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GUIDEBOOK

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A4P-F Chemical Sensors and Microsystems

Time: Monday, September 8, 2014, 16:30 - 18:30
Place: Poster Area
Chair(s): Ralf Moos, *University of Bayreuth, Bayreuth (Germany)*
Maria Teresa Gomes, *University of Aveiro, Aveiro (Portugal)*

A4P-F01 Electrolyte Insulator Semiconductor Structure for Pb+ Detecting

Rodrigo Reigota César[4], Angélica Denardi de Barros[1], Rafaela Oliveira Do Nascimento[2], Oswaldo Luiz Alves[3], Ioshiaki Doi[1], José Alexandre Diniz[4], Jacobus Willibrordus Swart[4]
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A4P-F02 Electrochemical Multi-Sensors Device Coupled with Heuristic or Meta-Heuristic Selection Algorithms for Single-Cultivar Olive Oil Classification

António Peres[3], Ana Veloso[2], José Pereira[1], Luís Dias[1]
[1]CIMO-ESA-IPB, Portugal; [2]IPC-ISEC, Portugal; [3]LSRE-ESA-IPB, Portugal

A4P-F03 Localized Surface Plasmon Resonance Sensor Based on Hetero-Core Structured Fiber Optic

Atsushi Seki, Kiyoaki Yoshikawa, Kazuhiro Watanabe
Soka University, Japan

A4P-F04 Micro-pellistor with Integrated Porous Alumina Catalyst Support

Ferenc Bíró[2], Andrea Edit Pap[1], István Bársony[1], Csaba Dücső[1]
[1]MTA TTK MFA, Hungary; [2]MTA TTK MFA / Uni. Veszprém, Hungary

A4P-F05 Enhanced Metrological Performances of Organic Electronic Ammonia Sensors Using Electro Spinning Techniques

Sentia Goursaud, Arnaud Agu, Jean-Luc Wojkiewicz, Nathalie Redon, Lahcen Khouchaf
Ecole des Mines-Douai, France

A4P-F06 Improvement of Explosive Detection by Fluorescence Sensor Using a Heating Device

Damien Rembelski, Geoffrey Gregis, Christelle Barthet, Céline Frenois
CEA Le Ripault, France

A4P-F07 Electrolyte Uptake Kinetics in Doped and undoped Sol-Gel Films Using a High Resolution EQCM Oscillator Sensor

Loreto Rodriguez-Pardo, Carmen Perez, Ana Cao-Paz, Jose Farina, Xose Ramón Novoa
University of Vigo, Spain

A4P-F08 Effect of High Pressure in Starch Viscoelastic Properties Studied with an Acoustic Wave Sensor

Maria Teresa Gomes, Maruro Santos, Jorge Saraiva
University of Aveiro, Portugal

ELECTROCHEMICAL MULTI-SENSORS DEVICE COUPLED WITH HEURISTIC OR META-HEURISTIC SELECTION ALGORITHMS FOR SINGLE-CULTIVAR OLIVE OIL CLASSIFICATION

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INTRODUCTION

ELECTRONIC TONGUE
(multi-sensor system)

↓

Chemical sensors with high stability and cross-sensitivity to different substances in solution

↓

TO OBTAIN
Signals profile corresponding to a *fingerprint* of sample matrix

↓

TO APPLY
Chemometric methods

↓

TO ALLOW
Sample's identification/classification
Taste evaluation
Multicomponent analysis

ELECTRONIC TONGUE

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Potenciometric system
(all-solid-state electrodes)

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20 lipidic polymeric membranes
Ag/AgCl reference electrode
Data acquisition with DataLogger Agilent

Each **lipidic polymeric membrane contains**:
31.9-32.3% of PVC;
64.7-65.2% of plasticizer;
2.8-3.2% of additive compound.

Additive compound
[1] Octadecylamine
[2] Oleyl alcohol
[3] Methyltrioctylammonium chloride
[4] Oleic acid
Plasticizer
[A] Bis(1-butylpentyl) adipate
[B] Dibutyl sebacate
[C] 2-Nitrophenyl-octylether
[D] (2-ethylhexyl)phosphate
[E] Dioctyl phenylphosphonate

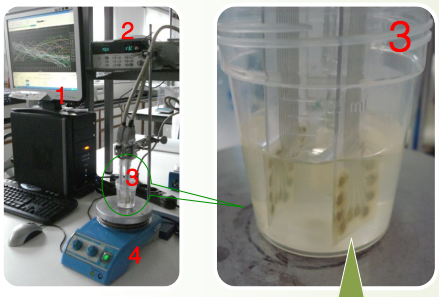

Figure 1 – Multi-sensor analytical system:
1 - PC for data acquisition;
2 - DataLogger Agilent;
3 – Electronic tongue;
4 – Magnetic stirrer.

Double multi-sensor system: 40 sensors

Electronic tongue analysis

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EXTRA VIRGIN OLIVE OILS (EVOO)
Production years: 2011 and 2012
9 single-cultivar per year

↓

Extraction with H2O:EtOH (80:20 v/v), to obtain a polar compounds rich-solution:
2011: 22 samples × 2 extractions
2012: 22 samples × 2 extractions

Cultivars:
Arbequina, ARB; Arbosana, ARBO; Arroniz, ARR;
Cornicabra, COR; Frantoio, FRA; Hojiblanca, HOJ;
Manzanilla, MAN; Picual, PIC; Redondilla, RED;
Royela, ROY; Zorzal, ZOR

OBJECTIVES

Apply heuristic and meta-heuristic variable selection algorithms. BEST APPROACH?

↓

To reduce the number of sensors included in a linear discriminant analysis (LDA) model, avoiding the use of redundant information and multicollinearity problems

↓

To classify EVOOs according to cultivar and crop year.

THE PRACTICAL AIM:

Improving the discrimination of EVOOs that are highly appreciated and an important component of the Mediterranean diet, being prone to frauds involving mislabelling and adulteration.

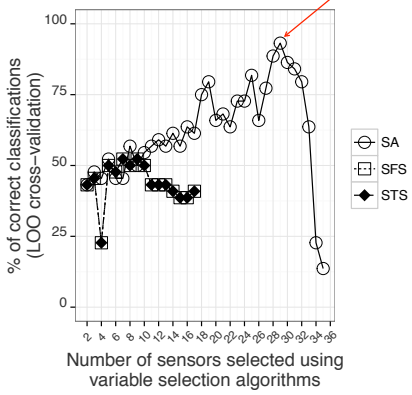
RESULTS

Variable selection algorithms:
HEURISTIC ALGORITHMS
sequential forward selection, SFS
sequential backward (elimination) selection, SBS
stepwise selection, STS

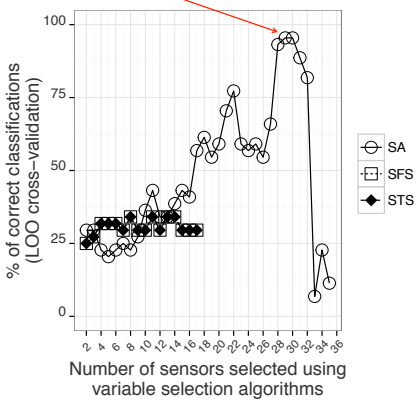
META-HEURISTIC ALGORITHM
simulated annealing, SA

Best LDA model:
- Maximum leave-one-out (LOO) cross-validation correct classification
- Minimum number of sensors

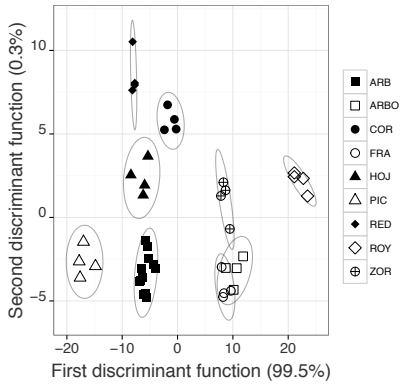
Production year: **2011**

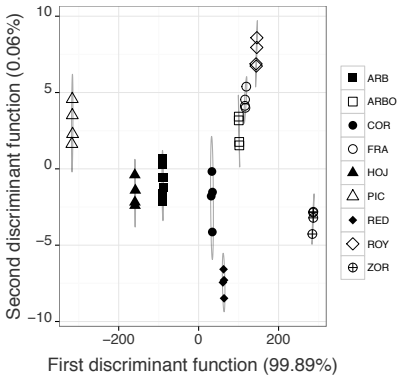


Production year: **2012**



Best LDA model:
→ variable selection with simulated annealing algorithm
→ model with 29 potentiometric sensor signals
→ 100% of correct classifications for original grouped data
→ 93.2% (2011) and 95.5% (2012) predictive LOO-CV correct classifications





CONCLUSIONS

- This potentiometric E-tongue coupled with a LDA-SA procedure is:
  → a fast and cost-effective tool for single-cultivar EVOOs classification;
  → a practical analytical methodology for guarantying cultivar authentication in single-cultivar EVOOs;
- However, EVOOs must be split according to production year to minimize differences in organoleptic atributes due to different edaphoclimatic conditions.

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