Fei ZHENG

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Working Experience

3/2018 – present
Postdoctoral researcher, *INRIA Grenoble, STATIFY (MISTIS)*
- Collaborated with *CEA-LETI*, *CHU Grenoble* and *Diabeloop SA*.
- **Project**: Characterization of glycemic variability in subject with type 1 diabetes. Unannounced meal detection for advanced artificial pancreas.
- **Supervisors**: Florence Forbe (*INRIA*), Stéphane Bonnet (*CEA-LETI*).

Education

11/2014 – 12/2017
PhD, *Ecole Centrale de Lyon (ECL)*.
- *Department of mathematics and information*.
- *Laboratoire d'InfoRmatique en Image et Systèmes d'information (LIRIS)*.
- **Thesis**: Learning and smoothing in switching Markov models with copulas [11].
- **Supervisors**: Stéphane Derrode (*ECL*), Wojciech Pieczynski (*Télécom SudParis*).

09/2011 – 03/2014
M.Eng, *Xidian University*, China.
- *Institute of Electronic Engineering*.
- *National Laboratory of Radar Signal Processing*.
- Major in Electronics and Telecommunications Engineering.
- **Thesis**: Research and implementation of Adaptive Side Lobe Cancellation system [12].

09/2007 – 06/2011
B.S, *Xidian University*, China.
- *School of Science*.
- Major in Electronic Information Science and Technology.
- **Dissertation**: Statistical analysis of radar sea clutter data.

Skills

Background
- Signal processing; statistical learning; time-series;
  model-based/free classification and outlier detection;
  non-linear non-Gaussian system approximation, filtering and prediction;
  phased array radar signal processing.

Programming language
- Python, Matlab, experience in R and C++ programming, Latex.
  Visual DSP++ for ADSP-TS201 TigerSHARC Processor (ADI).

Language
- Chinese (native), English (fluent), French (B2-C1).

Research & Engineering Projects

7/2019 – present **Unannounced meal detection for advanced artificial pancreas.**

- Extended Isolation Forest (EIF), Python.
  - Patient profile identification using Medtronic Virtual Patient (MVP) model.
  - EIF based unannounced meal detection algorithm [6].
  - Efficiency proven by evaluation on virtual subjects from SIMHOV[†].

3/2018 – present **Characterization of daily glycemic variability in subject with type 1 diabetes.**

- Mixture model (MMST), SVM, Matlab, R.
  - A framework which fuses Glycemic Variability (GV) metrics by MMST to a global index for daily GV evaluation and stability classification [2,4,7,10].
  - Comparison with Gaussian mixture, one-class SVM and diabetologists' labeling validates the performance of the framework tested on Trimeco data[‡].
  - Package (python, C++) of the framework is under development.

11/2014 – 12/2017 **Learning and smoothing in switching Markov models with copulas (PhD thesis).**

- EM algorithm, ICE algorithm, Kalman filter, Copula, Python.
  - Unsupervised algorithm (EM-based) for parameter estimation and data restoration of a Switching Hidden Markov System (SHMS) [3,9].
  - A new copula based non-linear non-Gaussian SHMS, which allows iterative algorithm (ICE-based) for its identification and exact Kalman filtering [1,8].
  - Model and algorithm validation by simulation with comparison to other SHMSs and restoration methods (such as particle filter).

03/2012 – 03/2014 **Implementation of the functions of meter-wave radar signal processing boards (Master thesis, project of China Jinjiang Info Industrial Co.,LTD[§]).**

- Adaptive Side Lobe Cancellation (ASLC), Matlab, Visual DSP++.
  - Linear/Non-linear Frequency Modulated ((N)LFM) radar wave form design.
  - Singular antenna array digital beam forming.
  - Implementation of real-time 3 auxiliary channels ASLC on ADSP TS201 DSP [5].
  - Performance evaluation under real radar working environment.

03/2011 – 09/2011 **Analysis of statistical characteristics of radar sea clutter (Bachelor dissertation)**.

- Matched filters, Goodness of Fit (GoF), Matlab.
  - LFM pulse compressed radar echo pre-processing (digital down conversion, matched filtering, moving target indication and detection, etc).
  - GoF analysis (Chi-Square, K-S, etc) of existing distributions (Rayleigh, Weibull, K, etc) applied to acquired sea cluster.

Teaching Experience

10/2019 – 01/2020 **Fundamentals of probabilistic data mining (2019-2020, Master 2)**
ENSIMAG, Grenoble INP.

- "Mixture models and Expectation-Maximization algorithm" (2 lectures, 1 labwork)
- "Variational inference" (1 labwork)

Publications

Journal

[1] F. Zheng, S. Derrode, W. Pieczynski. Semi-supervised Optimal Recursive Filtering and Smoothing in Non-Gaussian Markov Switching Models. *Signal Processing*, vol. 171, 2020. https://www.sciencedirect.com/science/article/pii/S0165168420300542

[2] F. Zheng, M. Jalbert, F. Forbe et al. Characterization of Daily Glycemic Variability in Subject with Type 1 Diabetes Using Mixture of Metrics. *Diabetes Technology & Therapeutics*, 22(4): 301-313, 2019. https://www.liebertpub.com/doi/abs/10.1089/dia.2019.0250

[3] F. Zheng, S. Derrode, W. Pieczynski. Parameter Estimation in Switching Markov Systems and Unsupervised Smoothing. *IEEE Transactions on Automatic Control*. 64(4): 1761-1767, 2019. https://ieeexplore.ieee.org/abstract/document/8425635

[4] M. Jalbert, F. Zheng, A, Wojtusciszyn et al. Glycemic Variability Indices Can Be Used to Diagnose Islet Transplantation Success in Type 1 Diabetic Patients, *Acta Diabetologica*, 57(3): 335-345, 2019. https://link.springer.com/article/10.1007%2Fs00592-019-01425-3

[5] J. Dong, C. Wang, F. Zheng, F. Luo. Effect of Channel Error on GPS Nulling Algorithm Performance (in Chinese). *Radio Engineering of China* 43(9): 24-27, 2013. https://caod.oriprobe.com/articles/39681963/Effect_of_Channel_Error_on_GPS_Nulling_Algorithm_P.htm

Conference proceeding

[6] F. Zheng, S. Bonnet, E. Villeneuve et al. Unannounced Meal Detection for Artificial Pancreas Systems Using Extended Isolation Forest. Accepted by *IEEE International Engineering in Medicine and Biology Conference (EMBC)*, Montreal, Canada, Jul, 2020.

[7] F. Zheng, S. Bonnet, F. Forbe et al. Caractérisation de la Variabilité Glycémique par Analyse Statistique Multivariée. *27ème Colloque Francophone de Traitement du Signal et des Images, (GRETSI)*, Aug, 2019. https://hal.archives-ouvertes.fr/hal-02415082/document

[8] F. Zheng, S. Derrode, W. Pieczynski. Fast Exact Filtering in Generalized Conditionally Observed Markov Switching Models with Copulas. *Traitement et Analyse de l'Information Méthodes et Applications (TAIMA)*, Hammamet, Tunisie, 2018. https://hal.archives-ouvertes.fr/hal-01786221/document

[9] F. Zheng, S. Derrode, W. Pieczynski. Parameter Estimation in Conditionally Gaussian Pairwise Markov Switching Models and Unsupervised Smoothing. *IEEE 26th International Workshop on Machine Learning for Signal Processing (MLSP)*, Salerno, Italy, Sept, 2016: 1-6. https://ieeexplore.ieee.org/abstract/document/7738907

Poster

[10] F. Zheng, M. Jalbert, F. Forbe et al. Caractérisation de la Variabilité Glycémique Journalière chez le Patient avec Diabète de Type 1, *Congrès de la Société Francophone du Diabète (SFD)* 2019. Poster communication affichée. https://hal.archives-ouvertes.fr/hal-01971621

Thesis

[11] Learning and Smoothing in Switching Markov Models with Copulas. PhD thesis, 2017. https://tel.archives-ouvertes.fr/tel-01998089

[12] Research on and Implementation of ASLC System (in Chinese), Master thesis. 2014. http://cn.oversea.cnki.net/kcms/detail/detailall.aspxfilename=1014330896.nh&dbcode=CMFD

[†] SIMHOV is a Hovorka model based virtual patient simulator provided by *Diabeloop SA*.

[‡] Trimeco trial is a nationwide (France) study concerning patients assigned to islet transplantation.

[§] *China Jinjiang Info Industrial Co.,LTD* is a subsidiary of *China Electronics Corporation*.