Sandy Throckmorton

Signal Analysis Solutions, LLC 22 Piney Grove Rd., Bahama, NC 27503 (855) 979-9663 sandy@signalanalysissolutions.com

PROFILE

- Expert in statistical signal processing, predictive analytics, machine learning, and pattern recognition
- Software Skills: Matlab, C, C++, Java, SQL
- Top secret security clearance

PROFESSIONAL EXPERIENCE

Signal Analysis Solutions, LLC, Durham, NC

Co-founder

- Apply data analytics techniques to detection and classification problems. Current and past projects have included analysis of laser-induced breakdown spectroscopy (LIBS) data, x-ray imagery data, accelerometer data, and spectroscopic data.
- Write custom software to allow non-experts to robustly apply data analytics techniques without expert oversight

2013 to Present

1996 to 2018

Duke University, Durham, NC

Senior Research Scientist	2008 - 2018
Research Scientist	2004 - 2007
Research Associate	2002 – 2003
Research Assistant	1996 – 2001

- Certified by the Duke Internal Review Board (IRB) for over 20 years to personally run experiments with human subjects and monitor experiments run by students involving human subjects
- Have served as the principal investigator (PI) or co-PI on multiple grants and contracts:
 - Co-PI"Using Machine Learning to Mitigate Reverberation Effects in Cochlear Implants"NIH/NIDCD\$1,800,00007/2015 07/2020
 - Co-PI "Towards Clinical Acceptability: Enhancing the P300-Based Brain Computer Interface" NIH/NIDCD \$2,000,000 09/2009 – 09/2016
 - Co-PI "Implementation and Tuning of Multi-Rate Speech Processors for Cochlear Implants" NIH/NIDCD \$750,000 01/2006 – 12/2010

PI "Classification of Ultrasonic Object Measurements through Physics-Based Model Inversion"

Signalscape	\$135,000	04/2007 – 06/2008
Signalscape	\$125,000	08/2008 - 03/2009
Signalscape	\$125,000	08/2009 - 04/2010

- Managed biomedical research lab, designing experimental protocols, guiding research directions, mentoring graduate students, and ensuring project goals were met
- Lead researcher on multiple statistical signal processing algorithm development efforts with a
 focus on applying advanced machine learning, pattern recognition, and classical Bayesian data
 analytic techniques to real-world problems. Current and past projects have included analysis of
 speech recognition data, electroencephalography (EEG) responses, eye gaze data, linguistic and
 emotion content in speech, ultrasound data, LIBS data, ground-penetrating radar (GPR)
 measurements, and electromagnetic induction (EMI) data.

New Folder Consulting, LLC, Durham, NC 2009 to 2013

Co-founder

- Developed software that provided real-time chemometric assessment of ink samples using LIBS data
- Applied data analytic techniques to multiple detection and classification problems, including discrimination of objects using spectroscopic data and detecting rebar in concrete using GPR data.
- Served as PI on a Small Business Technology Transfer (STTR) grant with the goal of providing custom software to cochlear implant wearers that would allow adjustment of their devices without clinical intervention:

PI "Towards Home-Fitting Software for Cochlear Implants"

NIH/NIDCD \$100,000 09/2011 - 09/2013

Other Experience

• Served on the NIH Sensory Technologies Small Business Grant Review panel 01/2012 – 11/2015

EDUCATION

Ph.D.: Electrical Engineering (Signal Processing)	2001
Duke University	Durham, NC
MS: Electrical Engineering (Signal Processing)	1998
Duke University	Durham, NC
BS: Electrical Engineering	1995
University of Texas – Arlington	Arlington, TX

REFEREED JOURNAL PUBLICATIONS

- Harmon, R.S., Throckmorton, C.S., Hark, R.R., Gottfried, J.L., Worner, G., Harpp, K., Collins, L.M., "Discriminating volcanic centers with handheld laser-induced breakdown spectroscopy (LIBS)," Journal of Archaelogical Science, October 2018.
- [2] Ryan, D.B., Colwell, K.A., Throckmorton, C.S., Collins, L.M., Caves, K., and Sellers, E.W., "Evaluating brain-computer interface performance in an ALS population: Checkerboard and color paradigms," Clinical EEG and Neuroscience, October 2017.
- [3] Kalika, D., Collins, L., Caves, K., Throckmorton, C., "Fusion of P300 and eye-tracker data for spelling using BCI2000," Journal of Neural Engineering, August 2017.
- [4] Mainsah, B.O., Reeves, G., Collins, L.M., and Throckmorton, C.S., "Optimizing the stimulus presentation paradigm design for the P300-based brain-computer interface using performance prediction," Journal of Neural Engineering, June 2017.
- [5] Harmon, R.S., Hark, R.R., Throckmorton, C.S., Rankey, E.C., Wise, M.A., Somers, A.M., and Collins, L.M., "Geochemical fingerprinting by handheld Laser-Induced Breakdown Spectroscopy (LIBS)," Geostandards and Geoanalytical Research, June 2017.
- [6] Clements, J.M., Sellers, E.W., Ryan, D.B., Caves, K., Collins, L.M., and Throckmorton, C.S., "Applying dynamic data collection to improve dry electrode system performance for a P300based brain computer interface," Journal of Neural Engineering, November 2016.
- [7] Mainsah, B.O., Collins, L.M., and Throckmorton, C.S., "Using detectability index to pre-assess P300 performance," Journal of Neural Engineering, October 2016.
- [8] Czarnek, N., Morton, K., Collins, L., Tantum, S., and Throckmorton, C., "The impact of time on seizure prediction performance in the FSPEEG database," Epilepsy & Behavior, July 2015.
- [9] Throckmorton, C.S., Mayew, W.J., Venkatachalam, M., and Collins, L.M., "Fraud detection using vocal, linguistic, and financial cues," Decision Support Systems, June 2015.
- [10] Mainsah, B.O., Collins, L.M., Colwell, K.A., Sellers, E.W., Ryan, D.B., Caves, K., and Throckmorton, C.S., "Increasing BCI communication rates with dynamic stopping towards more practical use: an ALS study," Journal of Neural Engineering, Vol. 12, January 2015.
- [11] Mainsah, B.O., Morton, K.D., Collins, L.M., Sellers, E.W., and Throckmorton, C.S., "Moving away from error-related potentials to achieve spelling correction in P300 spellers," IEEE Transactions on Neural Systems and Rehabilitation Engineering, November 2014.
- [12] Colwell, K.A., Throckmorton, C.S., Collins, L.M., and Morton, K.D., "Projected accuracy metric for the P300 speller," IEEE Transactions on Neural Systems and Rehabilitation Engineering, September 2014.
- [13] Mainsah, B.O., Colwell, K.A., Collins, L.M., and Throckmorton, C.S., "Utilizing a language model to improve online dynamic data collection in P300 spellers," IEEE Transactions on Neural Systems and Rehabilitation Engineering, July 2014.
- [14] Colwell, K.A., Ryan, D.B., Throckmorton, C.S., Sellers, E.W., and Collins, L.M., "Channel selection methods for the P300 speller," Journal of Neuroscience Methods, July 2014.
- [15] Desmond, J.M., Collins, L.M., and Throckmorton, C.S., "The effects of reverberant self- and overlap-masking on speech recognition in cochlear implant listeners," Journal of the Acoustical Society of America, June 2014.
- [16] Desmond, J.M., Collins, L.M., and Throckmorton, C.S., "Using channel-specific statistical models to detect reverberation in cochlear implant stimuli," Journal of the Acoustical Society of America, August 2013.

- [17] Throckmorton, C.S., Colwell, K.A., Ryan, D.B., Sellers, E.W., and Collins, L.M., "Bayesian approach to dynamically controlling data collection in P300 spellers," IEEE Transactions on Neural Systems and Rehabilitation Engineering, May 2013.
- [18] Duran, S.I., Collins, L.M., and Throckmorton, C.S., "Stream segregation on a single electrode as a function of pulse rate in cochlear implant listeners," Journal of the Acoustical Society of America, December 2012.
- [19] Stohl, J. S., Throckmorton, C. S., and Collins, L. M., "Investigating the effects of stimulus duration and context on pitch perception by cochlear implant users," Journal of the Acoustical Society of America, July 2009.
- [20] Morton, K. D., Torrione, P. A., Throckmorton, C. S., and Collins, L. M., "Mandarin Chinese tone identification in cochlear implants: Predictions from acoustic models," Hearing Research, October 2008.
- [21] Stohl, J. S., Throckmorton, C. S., and Collins, L. M., "Assessing pitch structure due to multiple rates and places in cochlear implants," Journal of the Acoustical Society of America, February 2008.
- [22] Remus, J. J., Throckmorton, C. S., and Collins, L. M., "Expediting the identification of impaired channels in cochlear implants via analysis of speech-based confusion matrices," IEEE Transactions on Biomedical Engineering, December 2007.
- [23] Throckmorton, C. S., Kucukoglu, M. S., Remus, J. J., and Collins, L. M., "The effect of frequency estimation on speech recognition using an acoustic model of a cochlear implant," Hearing Research, June 2007.
- [24] Throckmorton, C. S., Tantum, S. L., Tan, Y. Y., and Collins, L. M., "Independent component analysis for UXO detection in highly cluttered environments," Journal of Applied Geophysics, March 2007.
- [25] Throckmorton, C. S., Kucukoglu, M. S., Remus, J. J., and Collins, L. M., "Acoustic model investigation of a multiple carrier frequency algorithm for encoding fine frequency structure: Implications for cochlear implants," Hearing Research, June 2006.
- [26] Torrione, P. A., Throckmorton, C. S., Collins, L. M., "Performance of an adaptive feature-based processor for a wideband ground penetrating radar system," IEEE Transactions on Aerospace and Electronic Systems, April 2006.
- [27] Throckmorton, C. S., and Collins, L. M., "The effect of channel interactions on speech recognition in cochlear implant subjects: predictions from an acoustic model," J. Acoust. Soc. Am., July 2002.
- [28] Throckmorton, C. S., and Collins, L. M., "A comparison of the performance of two loudness balancing tasks in cochlear implant subjects," Ear and Hearing, October 2001.
- [29] Collins, L. M., and Throckmorton, C. S., "Investigating perceptual features of electrode stimulation via a multidimensional scaling paradigm," J. Acoust. Soc. Am., November 2000.
- [30] Throckmorton, C.S. and Collins, L.M., "Investigation of the effects of temporal and spatial interactions on speech recognition skills in cochlear implant subjects," J. Acoust. Soc. Am., February 1999.