

# Filip Dabek

## Machine Learning & Visualization

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### Data is Everything

#### Research Interests

While my research interests span a wide range of domains and are ever expanding to new-found areas, below is the core of the research that I have published thus far.

- Visualization Building new visualization techniques for big data with the goal of uncovering new insights. I am especially interested in the utilization of machine learning techniques to make intelligent visualizations.
- Healthcare Implementing techniques for applying machine learning and visualization into health-care to assist from both from a population health perspective: identifying different patient trajectories, discovering patterns in diagnoses, understanding healthcare utilization; and from a clinician-/patient-centric perspective: optimizing the clinical workflow through visualization and machine learning, informing both the clinician and patient with better tools and information.
- User Interaction Modelling and understanding a user's analytic process in order to be able to extract information about a specific interface, uncover insights about the data, identify differences between cohorts of users based on their behavior, provide suggestions to future users that make interactions within the system, and identify how optimal a given interface/system is.
- Machine Learning Discovering novel techniques and advances in order to improve the state-of-the-art performance on tasks spanning all domains.
- Irregular Events Irregular temporal events are ones that occur at irregular intervals, which leads to very noisy and messy data, thus I am interested in how to handle this type of common dataset without altering the transforming the data (PhD dissertation).

#### Experience

2014–Present **Data/Research Scientist, NICoE - National Intrepid Center of Excellence, Walter Reed Bethesda**, Bethesda, MD.

Lead research efforts for the Informatics group by devising a research plan each year and managing the progress.

Scope of Research/Responsibilities:

- Discover and build new visualization techniques on massive clinical data.
- Identify and formulate novel machine learning techniques for precision medicine (ex. diagnosis prediction, trajectory clustering, summarization).

- Apply machine learning techniques onto big data consisting of mild TBI (traumatic brain injury) patients.
- Oversee development of visualization tools and user interfaces to assist providers and researchers in the understanding of their data.

2011–Present **Technology Consultant**, *RAD-AID International*, Bethesda, MD.

Provide consulting in all aspects of technology for a non-profit focused on improving medical imaging and radiology in poor and developing regions.

Projects Include:

- Developed and published an iOS app that assists clinicians with reading Pubmed articles and linking them to their cases.
- Developed an internal portal that is used to handle the logistics of managing thousands of volunteers across the organization.
- Rebuilt and continue to oversee website:
  - Implemented an online store and a process for shipping logistics.
  - Developed a payments system to streamline the donation process.
  - Optimized server and related IT infrastructure.
  - Revamped the display and editing of website information.
- Continue to oversee and advise on technology related ventures.

2011–2012 **Undergraduate Research Assistant**, *DIADIC Laboratory*, Baltimore, MD.

Worked on a team to develop a peer-to-peer based system which allowed users to interact with browser extensions to be able to communicate with users all around the world.

2010–2011 **Mobile App Developer**, *AIMREC Enterprise*, Baltimore, MD.

Developed an iOS app, as freelance work, to allow the user to enjoy their favorite music in various formats. The app was published to the Apple App Store.

### Internships

Summer 2013 **Research Assistant**, *NICoE - National Intrepid Center of Excellence, Walter Reed Bethesda*, Bethesda, MD.

- Continued work on VisXplore (from Summer 2011) by adding more modules and supporting multiple data types allowing for clinicians and researchers to perform both single-subject and group analysis.
- Published and presented paper on work at Visual Analytics in Healthcare (VAHC) Workshop [13]

Summer 2012 **Visualization Developer**, *National Institutes of Health (NIH) - Center for Infectious Disease Imaging (CIDI)*, Bethesda, MD.

- Began work on a Clinical Data Visualization Framework to assist clinicians and researchers in analyzing large sets of clinical data.
- Presented work to both the CIDI group at NIH and the staff at NICoE Walter Reed Bethesda.

Summer 2011 **Mobile App Developer**, *National Institutes of Health (NIH) - Office of High Performance Computing and Communications (OHPCC)*, Bethesda, MD.

- Developed an iPhone app to aid medical researchers in analyzing pill information provided by the FDA.
- Created and optimized a database of over 14,000 pills to allow users of the app to access the information offline.
- Presented work to team within the OHPCC.

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## Miscellaneous

- **VAHC 2017 Paper Co-Chair** Served as Paper Co-Chair for the 2017 Visual Analytics in Healthcare Workshop at IEEE VIS 2017.
- **Reviewer** Continue to serve as a reviewer for a wide variety of conferences:
  - IEEE Visualization (2017-Present)
  - American Medical Informatics Association (AMIA) (2016-Present)
  - Visualizations in Healthcare (2015-Present)
  - INNS Big Data (2016)
- **CBIC 2016 Finalist & 2nd Place Winner** Entered a startup into an entrepreneurial competition held at UMBC: the annual Cnagialosi Business Innovation Competition (CBIC). Out of 30 teams, was one of 7 to be named a finalist. After pitching business plan for SupplySense to investors, won 2nd place in the competition: <https://entrepreneurship.umbc.edu/2016-cbic-winners-announced/>

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## Publications

### Papers

- [1] Dabek, Filip, Tim Oates, and Jesus J Caban. A reinforcement learning approach to automatically model and learn from user interactions. *IEEE transactions on visualization and computer graphics*, 2017 (*In Review*).
- [2] Dabek, Filip, Jian Chen, and Jesus J Caban. Trajectoryflow: Visual summarization of temporal sequences. *Journal of Information Visualization*, 2017 (*In Review*).
- [3] Dabek, Filip, Elizabeth Jimenez, and Jesus J Caban. A timeline-based framework for aggregating and summarizing electronic health records. In *Proceedings of the 2017 Workshop on Visual Analytics in Healthcare*, 2017.
- [4] Dabek, Filip J and Jesus J Caban. A k-reversible approach to model clinical trajectories. In *AMIA Annual Symposium Proceedings*, volume 2016, page 460. American Medical Informatics Association, 2016.
- [5] Dabek, Filip and Jesus J Caban. A grammar-based approach for modeling user interactions and generating suggestions during the data exploration process. *IEEE transactions on visualization and computer graphics*, 23(1):41–50, 2017.
- [6] Dabek, Filip, Jefferson E. McMillan, and Jesus J Caban. Clinically relevant filters to consider when designing a visualization for longitudinal electronic health records. In *Proceedings of the 2016 Workshop on Visual Analytics in Healthcare*, 2016.
- [7] Dabek, Filip. Leveraging big data to provide a web service that provides the likelihood of developing psychological conditions after a concussion. In *Mobile Services (MS), 2016 IEEE International Conference on*, pages 160–165. IEEE, 2016.
- [8] Dabek, Filip and Jesus J Caban. A grammar-based approach to model the patient's clinical trajectory after a mild traumatic brain injury. In *Bioinformatics and Biomedicine (BIBM), 2015 IEEE International Conference on*, pages 723–730. IEEE, 2015.

- [9] Dabek, Filip and Jesus J Caban. A neural network based model for predicting psychological conditions. In *International Conference on Brain Informatics and Health*, pages 252–261. Springer, Cham, 2015.
- [10] Dabek, Filip and Jesus J Caban. Leveraging big data to model the likelihood of developing psychological conditions after a concussion. *Procedia Computer Science*, 53:265–273, 2015.
- [11] Dabek, Filip John. *A grammar induction approach for learning and generating suggestions from user interactions*. PhD thesis, University of Maryland, Baltimore County, 2014.
- [12] Dabek, Filip, Jian Chen, Alexander Garbarino, and Jesus J Caban. Visualization of longitudinal clinical trajectories using a graph-based approach. In *Proceedings of the 2015 Workshop on Visual Analytics in Healthcare*, page 5. ACM, 2015.
- [13] Dabek, Filip and Jesus J Caban. Visxplore: flexible visualization system for analyzing complex clinical datasets. In *Proceedings of the 2013 Workshop on Visual Analytics in Healthcare*, page 14, 2013.

#### Posters

- [14] Dabek, Filip, Peter Hoover, and Jesus J Caban. Addressing the need for raw-valued dataset exploration in neural network visualization. In *Interpreting, Explaining and Visualizing Deep Learning Workshop at NIPS 2017*, 2017.
- [15] Dabek, Filip, Peter Hoover, Elizabeth Jimenez, and Jesus J Caban. Modelling & exploring clinical symptom trajectories post-traumatic brain injury. In *ML4H: Machine Learning for Health Workshop at NIPS 2017*, 2017.
- [16] Dabek, Filip, Peter Hoover, Elizabeth Jimenez, and Jesus J Caban. Trajectoryflow: Visual summarization of temporal sequences. In *IEEE VIS 2017*, 2017.
- [17] Dabek, Filip, Jian Chen, Alexander Garbarino, and Jesus J Caban. Visualization of longitudinal clinical trajectories using a graph-based approach. In *Visual Analytics in Healthcare (VAHC) Workshop at IEEE VIS 2015*, 2017.

#### Education

2014–2018 **Ph.D. Computer Science**, *University of Maryland, Baltimore County (UMBC)*.  
 2014–2014 **M.S. Computer Science**, *University of Maryland, Baltimore County (UMBC)*.  
 2010–2013 **B.S. Computer Science**, *University of Maryland, Baltimore County (UMBC)*.

#### Doctoral Dissertation

title *Analysis of Irregular Event Sequences using Deep Learning, Reinforcement Learning, and Visualization*  
 committee Tim Oates (chair), Jesus J Caban, Penny Rheingans, Jian Chen, Tim Finin

description When faced with noisy or irregular data, it has been recommended to undergo a pre-processing step of converting and transforming the data into being regular. This transformation technique arguably interferes on a fundamental level as to how the data is represented, and may irrevocably bias the way in which results are obtained. In this dissertation novel approaches are presented for performing common event analysis tasks directly on irregular event sequences using a variety of techniques ranging from deep learning, reinforcement learning, and visualization. The three tasks showcased include: (i) summarization of large event datasets, (ii) modeling the processes that create events, and (iii) predicting future events that will occur.

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## Master's Thesis

title *A Grammar Induction Approach for Learning and Generating Suggestions from User Interactions*

committee Tim Oates (chair), Jesus J Caban, Penny Rheingans

description The tedious and difficult process of analyzing visualizations presents situations where patterns and trends in data may potentially never be found and thus the need for guiding a user is important. Existing approaches for solving such problems typically display the history of interactions, relying on the user to identify their own missteps and find the correct path on the way to the answer. An grammar induction approach is presented that assists users in obtaining answers to their research questions through the use of interaction suggestions that both identify lost users and keep users on track to find an answer, thus improving their performance.

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## Languages

English Fluent

Polish Fluent

Spanish Beginner