

LRDC Self-Report: Spring 2017
(Covering the period *May 2016 - April 2017*)

NAME: Diane Litman

Please attach an updated CV. Please submit all materials electronically to the Director's Office (mgibson@pitt.edu) by **May 3, 2017**.

1. HIGHLIGHTS FOR THE YEAR (e.g., Research/Scholarship, Grants, Service)

Argumentative Writing and Revision Research

We have been using natural language processing to analyze argumentative student papers and associated revisions between paper drafts. Funded by an NSF Cyberlearning award that has now ended, we have developed a fully automated system for automated argument mining that takes text as input and can identify argumentative functions of sentences (e.g., *hypothesis* or *claim*) and the relations between such sentences (e.g., *supports* or *opposes*).

- H. Nguyen (**Dissertation**). Context-Aware Argument Mining and its Applications in Education, April 2017.
- H. Nguyen & D. Litman, Context-aware Argumentative Relation Mining. *Proc. 54th Annual Meeting Association for Computational Linguistics*, pp. 1127-1137, August 2016.
- H. Nguyen & D. Litman, Improving Argument Mining in Student Essays by Learning and Exploiting Argument Indicators versus Essay Topics, *Proc. 29th International FLAIRS Conference*, pp. 485-490, May 2016. (**Best Student Paper Award**)

Funded by an ongoing NSF EAGER award, we developed methods to automatically extract revisions across paper drafts and to identify the argumentative functions of revisions (e.g., *add/delete/modify evidence*). We then developed a writing assistance system incorporating these methods, which was evaluated in a study with 60 users. Our findings suggest that feedback on revisions do impact how students review and rewrite their drafts. However, there are many factors at play, including the interface design and the students' linguistic backgrounds (native, L2). Our collected data has been released to the research community.

- F. Zhang (**Dissertation**). Towards Building an Intelligent Revision Assistant for Argumentative Writings, April 2017.
- F. Zhang, D. Litman & K. Forbes-Riley, Inferring Discourse Relations from PDTB-style Discourse Labels for Argumentative Revision Classification, *Proc. 26th International Conference on Computational Linguistics*, pp. 2615-2624, Dec. 2016.
- F. Zhang, R. Hwa, D. Litman & H. Hashemi, ArgRewrite: A Web-based Revision Assistant for Argumentative Writings. *Proc. Conference of the North American Chapter of the Association for Computational Linguistics: Demonstrations*, pp. 37-41, June 2016.
- F. Zhang & D. Litman, Using Context to Predict the Purpose of Argumentative Writing Revisions, *Proc. Conference of the North American Chapter of the Association for Computational Linguistics - Human Language Technologies*, pp. 1424-1430, June 2016.

Response-to-Text Writing Assessment at Scale

In analytical writing in response to text, students read a complex text and adopt an analytic stance in their writing about it. To evaluate this type of writing at scale, an automated approach for Response to Text Assessment (RTA) is needed. This year we received an external IES grant that greatly expands our prior LRDC internal award (e.g., involves new primary and secondary data analyses, moves from summative to formative assessment). To date we have recruited new PhD students, extended our automated scoring research (a paper is currently under review), and are collecting data in the Schnectady school district. We also published a journal paper summarizing our prior research on evaluating a set of interpretable features that operationalize the *Evidence* and *Organization* rubrics of RTA.

- Z. Rahimi, D. Litman, R. Correnti, E. Wang, & L. Matsumara, Assessing Student's Use of Evidence and Organization in Response-to-Text Writing: Using Natural Language Processing for Rubric-Based Automated Scoring, *International Journal of Artificial Intelligence in Education*, 2017.
- Z. Rahimi & D. Litman, Automatically Extracting Topical Components for a Response-to-Text Writing Assessment, *Proc. 11th Workshop on Innovative Use of NLP for Building Educational Applications*, pp. 277-282, June 2016.

Improving STEM Education: Natural Language Processing & Mobile Technologies

Interactions between students and instructors are crucial to the success of learning and teaching but are limited in large classrooms. Funded by an internal LRDC grant that ended June 2016, we developed CourseMIRROR, a mobile system that prompts students' self-reflection and in-situ feedback to enhance the interactions. My work has focused on using natural language processing to 1) develop automatic text summarization techniques that can aggregate student reflections and present the most significant ones to both instructors and students, and 2) automatically predict the quality of student reflections as quality has been shown to correlate with learning. CourseMIRROR incorporates our summarization techniques and has been evaluated in eight university classrooms with over 300 students.

- W. Luo (**Dissertation**). Automatic Summarization for Student Reflective Responses, April 2017.
- M. Menekse, W. Luo, X. Fan, J. Wang, & D. Litman, Exploring the Reflection and Feedback Cycle to Enhance Engineering Students' Learning. Stand-Alone Paper presentation, *National Association of Research in Science Teaching meeting*, April 2017.
- X. Fan, W. Luo, M. Menekse, D. Litman, & J. Wang, Scaling Reflection Prompts in Large Classrooms via Mobile Interfaces and Natural Language Processing, *Proc. of the 22nd International Conference on Intelligent User Interfaces*, pp. 363-374, March 2017.
- W. Luo, F. Liu & D. Litman, An Improved Phrase-based Approach to Annotating and Summarizing Student Course Responses, *Proc. of the 26th International Conference on Computational Linguistics*, pp. 53-63, December 2016.
- W. Luo, F. Liu, Z. Liu & D. Litman, Automatic Summarization of Student Course Feedback, *Proc. Conference of the North American Chapter of the Association for Computational Linguistics - Human Language Technologies*, pp. 80-85, June 2016.

- W. Luo & D. Litman, Determining the Quality of a Student Reflective Response, *Proc. 29th International FLAIRS Conference*, pp. 226-231, May 2016. (**Best Student Paper Award Nominee**)

New Grants and Total Publications

- **PI**, Response-to-Text Tasks to Assess Students' Use of Evidence and Organization in Writing: Using Natural Language Processing for Scoring Writing and Providing Feedback At-Scale (with R. Correnti and L. Matsumura (Co-PIs)), US Department of Education, September 2016-August 2019, \$1,398,589.
- **PI**, Using Natural Language Processing to Study the Role of Specificity and Evidence Type in Text Based Classroom Discussions (with A. Godley (Co-PI)), LRDC Internal Grant Competition, July 2016-June 2018, \$147,592.
- **Senior Personnel**, Subthalamic and Corticosubthalamic Coding of Speech Production (with M. Richardson (PI) & Julie Fiez), NIH, September 2016-May 2019, \$1,028,607 (LRDC portion \$46,785 per year).
- 2 journal, 14 conference, 1 workshop publications during May 2016 - April 2017.

2. SCHOLARLY GOALS FOR THE COMING YEAR

My efforts will be focused on the projects that have both continued funding and students pursuing related dissertation research: Response-to-Text Writing Assessment (IES), classroom discourse (LRDC), and team conversations (NSF, not highlighted above). I also have pending grants in the areas of argumentative writing and revision (with Godley/Hwa), improving STEM education (with Meneske/Wang), and learning analytics (with Epp).

3. INTERNATIONAL SCHOLARLY ACTIVITIES (collaborations, conferences, boards, etc)

I continue collaborating with the National University of Singapore (along with Carrie Demmans Epp) to understand when instructors intervene in MOOC discussion forums.

- M. Chandrasekaran, C.Epp, M. Kan & D.Litman, Using Discourse Signals for Robust Instructor Intervention Prediction, *Proc. 31st AAAI Conference on Artificial Intelligence*, February 2017.

I concluded my collaboration with Cambridge University (UK) on the use of spoken dialogue systems for assessment of non-native English speakers.

- D. Litman, S. Young, M. Gales, K. Knill, K. Ottewell, R. van Dalen & D. Vandyke, Towards Using Conversations with Spoken Dialogue Systems in the Automated Assessment of Non-Native Speakers of English, *Proc. 17th Annual SIGdial Meeting on Discourse and Dialogue*, pp. 270-275, September 2016.

See CV for international editorial, conference, board duties, presentations, and publications.

4. RESEARCH TRAINING AND MENTORING Indicate names of post-docs and graduate students and numbers of undergraduate working under your supervision on research in LRDC. (Do not include undergraduate or graduate classroom teaching)

4.1. Post-docs (LRDC/CIDDE)

- Carrie Demmans Epp

4.2. PhD Graduate Students (5 Computer Science, 1 Intelligent Systems)

- Luca Lugini
- Wencan Luo
- Huy Nguyen
- Zahra Rahimi
- Colin Zhang
- Fan Zhang

4.3. Undergraduates (NSF REU and Pitt First Experience in Research Programs)

- Cassandra Boutin
- Zane Denmon
- Anish Kumar
- Rehana Saiffee
- Jan Yang
- Zinan Zhuang

5. LRDC Service

- Executive Committee

6. MISCELLANEOUS (including comments or suggestions about LRDC, if any)

PhD Student Advising

- Luo, Nguyen, and Zhang all defended their PhD dissertations, April 2017.
- Nguyen won the Best Student Paper Award at the 29th International Florida Artificial Intelligence Research Society Conference, May 2016.

Invited Speaker

- Vital Infrastructure: AI's Role in our Shared Future, *AI XPRIZE + Pittsburgh's AI Experts*, Pittsburgh, PA, November 2016.
- Cooperation in Dialogue Systems from Eliza to Alexa, *NSF-supported workshop on Uphill Battles in Language Processing: Scaling Early Achievements to Robust Methods*, Austin, TX, November 2016.

New Professional Activities

- Co-Organizer, *Third Workshop on Argumentation Mining*, June 2016.
- Joined Editorial Board, *Argument and Computation*, May 2016.