Muntabir Hasan **CHOUDHURY**

Computer Science | Ph.D. Candidate

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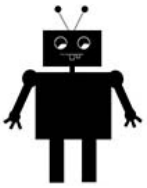

I am a Ph.D. Candidate in the department of Computer Science at **Old Dominion University**. Currently, I am collaborating on a research project with **Virginia Polytechnic Institute and State University**, supported by the **Institute of Museum Library Services** for a grant **LG-37-19-0078-198**. My research project is mining book-length scholarly data, such as **Electronic Theses and Dissertations (ETDs)** using **Artificial Intelligence** techniques, including **natural language processing**, **computer vision**, **machine learning**, and **deep learning**. The project addresses the lack of research in this type of book-length document, including extracting and improving metadata, segmenting documents (e.g., chapters, reference lists, tables, figures, and references), and developing methods for summarizing individual chapters to enable findability and minimize the accessibility issue. This research will help us build a scalable digital library that would benefit all librarians, student researchers, and scientists in academia and the digital library domain.

Education

Present – August 2019 | **Old Dominion University | Norfolk, VA, United States**
- **Ph.D. Candidate** in **Computer Science**
- **GPA :** 3.84/4.00
- **Research Interest :** Natural Language Processing, Computer Vision, Machine Learning, Deep Learning, Scholarly Big Data, and Digital Libraries.

May 2018 – August 2014 | **Elizabethtown College | Elizabethtown, PA, United States**
- **Bachelor of Science** in **Computer Engineering**
- **Minor :** Information Systems
- **GPA :** 3.36/4.00

Research Experience

Present – August 2019 | **Graduate Research Assistant | Old Dominion University | Norfolk, VA, United States**
- Mining scholarly big data such as Electronic Theses and Dissertations (ETDs) using NLP techniques.
- Developed AI methods using Computer Vision and NLP techniques to extract metadata from ETDs.
- Used AI-based approach (e.g., deep learning, machine learning) to improve the metadata quality (e.g., filling in missing values, correcting misspellings, and canonicalizing the surface values) in the digital library to minimize the problems of indexing, data retrieving, and accessibility.
- Developing methods for segmenting scanned book-length documents (e.g., table, figure, chapters) using ETD as a case study.
- Developing methods to parse reference strings from ETDs.
- Mentoring students, writing research papers, and presenting research work at top conferences and journals.

Natural Language Processing | Computer Vision | Machine Learning | Deep Learning | Scholarly Big Data | Digital Libraries

Peer Reviewed International Conferences and Journals

1. **Muntabir Hasan Choudhury**, Lamia Salsabil, William A. Ingram, and Edward A. Fox, Jian Wu. ETDPC : A Multimodality Framework for Classifying Pages in Electronic Theses and Dissertations. In Proceedings of Innovative Applications of Artificial Intelligence (IAAI-24). **under REVIEW**.
2. **Muntabir Hasan Choudhury**, Lamia Salsabil, Himarsha R. Jayanetti, Jian Wu, William A. Ingram, and Edward A. Fox. MetaEnhance : Metadata Quality Improvement for Electronic Theses and Dissertations of University Libraries. In Proceedings of ACM/IEEE Joint Conference on Digital Libraries (JCDL 2023), 2023. (**Best Short Paper Award**) pre-print link
3. Kehinde Ajayi, **Muntabir Hasan Choudhury**, Sarah Rajtmajer, and Jian Wu. A Study on Reproducibility and Replicability of Table Structure Recognition Methods. In Proceedings of International Conference on Document Analysis and Recognition, (ICDAR 2023), 2023. paper link pre-print link

4. Lamia Salsabil, Jian Wu, **Muntabir Hasan Choudhury**, William A. Ingram, Edward A. Fox, Sarah J Rajtmajer, and C. Lee Giles. A Study of Computational Reproducibility using URLs Linking to Open Access Datasets and Software. In Sci-K '22 : 2nd International Workshop on Scientific Knowledge, April 25–26, 2022, Virtual. ACM, New York, NY, USA. paper link
5. Md Reshad Ul Hoque, Xin Wei, **Muntabir Hasan Choudhury**, Kehinde Ajayi, Martin Gryder, Jian Wu, and Diane Oyen. Segmenting Technical Drawing Figures in US Patents. In Proceedings of AAAI-22 Workshop on Scientific Document Understanding, 2022. paper link
6. **Muntabir Hasan Choudhury**, Himarsha R. Jayanetti, Jian Wu, William A. Ingram, and Edward A. Fox. Automatic Metadata Extraction Incorporating Visual Features from Scanned Electronic Theses and Dissertations. In Proceedings of ACM/IEEE Joint Conference on Digital Libraries (JCDL 2021), 2021. paper link pre-print link
7. **Muntabir Hasan Choudhury**, Jian Wu, William A. Ingram, and Edward A. Fox. A Heuristic Baseline Method for Metadata Extraction from Scanned Electronic Theses and Dissertations. In Proceedings of ACM/IEEE Joint Conference on Digital Libraries (JCDL 2020), 2020. paper link
8. William A. Ingram, Jian Wu, Sampanna Yashwant Kahu, Javaid Akbar Manzoor, Bipasha Banerjee, Aman Ahuja, **Muntabir Hasan Choudhury**, Lamia Salsabil, Winston Shields and Edward A. Fox.Building Datasets to Support Information Extraction and Structure Parsing from Electronic Theses and Dissertations. International Journal on Digital Libraries (IJDL). **(under REVIEW)**

Posters & Extended Abstracts

1. **Muntabir Hasan Choudhury**. ETDSuite : An Library for Mining Electronic Theses and Dissertations. Proceedings of ACM/IEEE Joint Conference on Digital Libraries (JCDL 2023), 2023.
2. **Muntabir Hasan Choudhury**, Lamia Salsabil, Himarsha R. Jayanetti, Jian Wu, William A. Ingram, and Edward A. Fox. MetaEnhance : Metadata Quality Improvement for Electronic Theses and Dissertations. link video link
3. **Muntabir Hasan Choudhury**, Jian Wu, William A. Ingram, and Edward A. Fox. A Heuristic Baseline Method for Metadata Extraction from Scanned Electronic Theses and Dissertations. In Proceedings of ACM/IEEE Joint Conference on Digital Libraries (JCDL 2020), 2020. (**Best Poster Award**) link video link

Reviewed Papers

2023 **ACM/IEEE Joint Conference on Digital Libraries 2023** – One Paper Review
2022 **ACM/IEEE Joint Conference on Digital Libraries 2022** – One Paper Review
2020 **ACM/IEEE Joint Conference on Digital Libraries 2020** – 10 Poster Abstracts Review

Honors and Awards

2023 **Dominion Scholar Award** from **Old Dominion University Computer Science**
2023 **Best Short Paper Award** from **ACM/ IEEEJoint Conference on Digital Libraries (JCDL 2023)**
2023 **Received Travel Grant of $500** from **Old Dominion University SEES Award**
2023 **Received Travel Grant of $1,420** from **ACM SIGIR**
2022 **Outstanding Teaching Assistant Award** from **Old Dominion University**
2020 **Best Poster Award** in **ACM/ IEEE Joint Conference on Digital Libraries (JCDL 2020)**
2020 **Dr. Hussain Abdel-Wahab Graduate Fellowship** from **Old Dominion University Computer Science**
2020 Received **AML Summer Research Fellowship** from **Los Alamos National Laboratory**
2018 **Sigma Pi Sigma** Honor – **National Physics Honor Society**
2017 **Sigma Alpha Pi** Honor – **The National Society of Leadership and Success**
2016 **Dean's List** Honor – **Elizabethtown College**
2014 **International Scholarship** Recipient – **Elizabethtown College**

Teaching and Mentoring

Spring 2023
Fall 2021

CS 722/822 : Machine Learning | Old Dominion University | Norfolk, VA, United States
Supervisor : Dr. Fengjiao Wang and Dr. Jiangwen Sun

- Helped students to understand the theoretical concepts of the mathematics behind machine learning models, including regression models, neural networks (e.g., CNN), clustering, and KNN.
- Created homework and exam solutions, graded homework, project reports, and codes.
- Hold TA sessions each week to help students with their homework assignments.

Supervised Learning | Unsupervised learning | Linear Regression | Logistic Regression | Neural Network)

Fall 2022 – Fall 2019

CS 418/518 : Web Programming | Old Dominion University | Norfolk, VA, United States
Advisor/Supervisor : Dr. Jian Wu

- Assisted students with their semester project on search engine development using LAMP (Linux, Apache, MySQL, and PHP) technologies and ElasticSearch.
- Helped students with document indexing using **Elasticsearch**, graded assignments and project reports, and reviewed programming code.
- Prepared datasets and delivered them to the students for the semester project.
- Provided demo to the students on using Wikifier API and example code to call Wikifier API to identify keyphrases from the text and store the keyphrase in JSON object.
- Gave a talk as a guest speaker regarding industry experience.

Linux | Apache | MySQL | PHP | Elasticsearch | Guest Lecture

Fall 2020

CS 170 : Introduction to Computer Architecture | Old Dominion University | Norfolk, VA, United States
Supervisor : Dr. Yaohang Li

- Created homework solutions and graded 40 assignments per week.
- Hold TA sessions each week to help students with their homework assignments.
- Helped students to better understand some of the computer architecture materials such as logic diagrams, truth tables, floating point representations, MIPS Instructions, and Conditional Instructions.

May 2018 – August 2016

Teaching Assistant : Computer Architecture | Elizabethtown College | Elizabethtown, PA, United States
Supervisor : Dr. Joseph T. Wunderlich

- Tutored students and assisted with coursework and assignments for Computer Architecture.
- Researched on PLC control (e.g., Nano LC Programmable Logic Controller and AXC PLCnext Control).
- Assisted students in laboratory tasks and graded over 20 assignments per week.

Professional Experience

August 2021 – June 2021

Machine Learning Intern | Bihrle Applied Research Inc | Hampton, VA, United States

- Contributed to a project (i.e., BNSF Railway and FAA's Pathfinder Program) to study and develop technologies for drone-based supplemental inspection of railway infrastructure.
- Developed and enhanced algorithms for train detection used by Rail-Inspector – a cloud-based software that processes aerial imagery of railroad tracks using machine learning and deep learning.
- Built ground truth by labeling images for trains, used deep Learning models such as a Fully Convolutional Network for segmentation, analyzed, and optimized the result.
- Achieved an accuracy of 96% for detecting trains on the railway and helped the partial implementation of the segmentation model in the production cycle.

Python | SQL | C++ | Anaconda | TensorFlow | PyTorch | OpenCV | Computer Vision | Image Processing

August 2020 – June 2020

Research Intern | Los Alamos National Laboratory | Los Alamos, NM, United States

- Studied and researched historical archives at LANL, which consist of handwritten mathematical expressions (HME) embedded with text or images.
- Implemented a framework for offline HME recognition and employed computer vision techniques for feature extraction.
- Preprocessed images, built ground truth data, and applied OpenCV for segmentation, blurring, and binary thresholding.
- Employed deep neural networks such as LeNET5-CNN, normalized input vectors, applied one hot encoding and used sampling to achieve an optimal model performance of 89% accuracy.

Python | Anaconda | TensorFlow | Keras | OpenCV | Git | Deep Learning | Computer Vision

July 2019
September 2018

Application Performance Engineer | Resource9 Group Inc | Long Island City, NY, United States

- Used AppDynamics (i.e., monitoring technology) to create health rules, policies, and alerts on tier and node levels to identify severe slowdown in the application or any issues with server infrastructure.
- Managed 10 mission-critical applications using AppDynamics, monitored transaction snapshots by drilling down the full call stack, and identified root causes of problems.
- Solved hardware-level issues, such as memory leak detection, garbage collection, heap utilization, and thread contention.
- Resolved business transaction-related problems by configuring POCO and POJO entry points, improved operations, integrated applications with agents (i.e., JAVA agent, .NET agent, DB agent, EUM agent, machine agent), and educated customers with best practices and guidelines.

Linux | Java | .NET | Docker | AWS | Git

May 2018
January 2017

Database Assistant | Elizabethtown College | Elizabethtown, PA, United States

- Used Jenzabar Ex (i.e., an higher education database) for updating relationships, salutations, and records for any individual or organization who joined as a potential donor and Alumni.
- Performed SQL to identify duplicate records and cleaned unnecessary data to avoid inconsistency.
- Created thousands of new database records for individuals or organizations who want to receive newsletter emails.

SQL | RDBMS | Excel

August 2017
June 2017

Undergraduate Research - Data Analytics | Elizabethtown College | Elizabethtown, PA, United States

- Researched "Etown Means Business – Impact on Philanthropy at Elizabethtown College".
- Analyzed the dataset using data visualization techniques such as box plot, scatter plot, and histogram.
- Identified duplicate records in the database and queried the database using SQL to collect, update, and insert records.
- Implemented machine learning models such as multivariate linear regression to predict variables which made a great impact on philanthropy.

SQL | R | RDBMS | Machine Learning

Projects

AutoMeta

August 2019 - January 2021

github.com/lamps-lab/AutoMeta Presentation JCDL 2021

AutoMeta is a metadata extractor application to extract metadata fields from scanned book-length documents such as electronic theses and dissertations (ETDs) by leveraging NLP techniques. It uses ML-based methods such as **Conditional Random Field (CRF)**, which incorporates text and visual features. The model was trained and evaluated using AutoMeta-ETD500, and achieved F1 score of **83% – 96%**.

OCR | Machine Learning | Digital Libraries | Scholarly Big Data | NLP

ETDPC

March 2021 - Present

github.com/lamps-lab/ETDMiner/tree/master/etd_segmentation

A two-stream novel multi-modal classification model with cross-attention that uses vision encoder (**ResNet50v2**) and text encoder (**BERT with Talking-Heads Attention**) to classify ETD pages into 13 categories. The model was trained and evaluated using ETDPC-ETD500, and achieved F1 score of **84% – 96%**.

AWS Textract | Tensorflow | Computer Vision | Deep Learning | Machine Learning | LLMs | NLP | Digital Libraries | Scholarly Big Data

MetaEnhance

May 2022 - December 2022

github.com/lamps-lab/ETDMiner/tree/master/metadata_correction

An application to improve the metadata quality of ETDs by filling out the *missing values*, correcting the *incorrect values* and *misspellings*, and *canonicalizing the surface values* by leveraging the SOTA ML and DL models. The framework was evaluated against MetaEnhance-ETDQual500 and achieved nearly perfect F1-scores in detecting errors and F1-scores ranging from **85% – 100%** for correcting five of seven key metadata fields.

OCR | Python | Machine Learning | Deep Learning | NLP | Digital Libraries | Metadata Quality

Programming Skills/Frameworks/Others

Programming	Python, SQL, PHP, C, HTML, CSS
Technologies/APIs	Keras, TensorFlow, PyTorch, OpenCV, NLP toolkit, scikit-learn, pandas, numpy
Database	MySQL, Microsoft SQL Server, AWS S3
Development Tools	Anaconda, Jupyter Notebook, Visual Studio Code, SVN, git, Docker, AWS
Operating Systems	Linux, Mac OS X, Windows Server