FARIA HUQ

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RESEARCH INTEREST

- Creative Toolkit Design
- Human-in-the-loop AI agents
- Personalized AI agents

EDUCATION

- **Doctor of Philosophy** **August '22 - Present**
  : *School of Computer Science, Carnegie Mellon University*
  Supervisor : Prof. Jeff Bigham
- **Bachelor of Science in Computer Science and Engineering** **2016 - 2021**
  : *Bangladesh University of Engineering and Technology, Dhaka*
  (Academic Session Delay due to COVID-19 pandemic)
  Thesis Dissertation: Review4Repair: Code Review Aided Automatic Program Repairing

PUBLICATIONS & PREPRINTS

1. *"What's important here?": Opportunities and Challenges of Using LLMs in Retrieving Information from Web Interfaces*.
   F. Huq, Jeff Bigham, Nikolas Martelaro. **Accepted** at NeurIPS Robustness of Few-shot and Zero-shot Learning in Foundation Models Workshop, 2023
2. *graphiti: Sketch-based Graph Analytics for Images and Videos*.
   N. Saquib, **F. Huq**, S. A. Haque. **Accepted** at CHI 2022 (*direct accept*, *rate: 12.5%*), (doi)
3. *Review4Repair: Code Review Aided Automatic Program Repairing*.
   F. Huq, M. Hasan, M.A.H. Haque, S. Mahbub, A. Iqbal, T. Ahmed. **Published** in Information and Software Technology, 2021 (doi)
4. *A Tale on Abuse and Its Detection over Online Platforms, Especially over Emails: From the Context of Bangladesh*.
   I. Haque, R. Adnin, S. Afroz, **F. Huq**, S. Mahbub, A. B. M. Islam. **Published** in NSysS 2021 (*acceptance rate: 16.67%*), (doi)
5. *Riemannian Functional Map Synchronization for Probabilistic Partial Correspondence in Shape Networks*.
   F. Huq, A. Dey, S. Yusuf, D. Bazazian, T. Birdal, N. Miolane. (ArXiv 2111.14762), (blog)
6. *Static and Animated 3D Scene Generation from Free-form Text Descriptions*. **F. Huq**, N. Ahmed, A. Iqbal. (ArXiv 2010.01549)

RESEARCH EXPERIENCE

1. **Graduate Research Project, CMU HCII**
   Supervisors : Prof. Jeff Bigham
   Project Members: Jason Wu, Yi-Hao Peng, David Chaun-en Lin

   (a) **Noteeline: Personalized and Contextualized Note-taking Tool** **October '23 - Present**
   : *LLM, In-context Learning, User Modelling*

   - Large Language Models (LLMs) have demonstrated effectiveness in summarizing long-form documents. However, commercially available note-taking tools based on summarization using LLMs often lack personalization and contextualization. To address this gap, we are developing a novel note-taking tool that leverages user-provided short notes to expand and create comprehensive notes tailored to the individual's needs. We employ techniques such as instruction tuning and user embedding to achieve a higher level of personalization than existing tools like Notion and Goodnote.

   (b) **User Intention Prediction from Interaction Trace in Web Interfaces** **September '23 - Present**
   : *LLM, In-context Learning*

   - By predicting user intention for webpages through their interaction trace, we can uncover what the user is aiming to do, potentially suggesting automation execution of the remaining parts or providing just-in-time intervention when they seem to be struggling to find the information they are looking for. To this end, we aim to predict user intention from their interaction trace with two objectives: 1) what is their actual goal that they are trying to achieve now? 2) what is the future trajectory of actions the user is likely to execute? We explore various state-of-the-art prompting techniques to efficiently encode user traces and current HTML DOM into the context.

   (c) **"What's important here?": Opportunities & Challenges of Using LLMs in Retrieving Information from Web Interfaces March '23 - September' 23**
   : *LLM, Prompt Engineering, Web Interface*

   - We design an in-depth study to see how the code understanding ability of LLMs can be used to retrieve and locate important elements for a user given query (*i.e.* task description) in web interface. In contrast with prior works, which primarily focused on autonomous web navigation, we decompose the problem as an atomic operation - *Can LLMs find out the important information in the web page for a user given query?* This decomposition enables us to scrutinize the current capabilities of LLMs and uncover the opportunities and challenges they present. Carefully prompting the few-shot examples can help LLMs to succeed as long as the input sequence size is reasonable. For instance– using lexico-semantically similar few-shot examples can boost the recall by **9.70%** in 1-shot prompting; however, it decreases the performance by **13.17%** in 2-shot prompting. We also show that an effective way to truncate the HTML document can

alone lead to better performance with gains upto **11.54%**. We unveil critical limitations of LLMs such as hallucination and failure to follow instruction in terms of UI element retrieval.

(d) **Predicting functional Importance in Mobile User Interface** **September '22 - March '23**
: *Accessibility, Mobile Interface, Computer Vision*

- We aim to predict functional importance from mobile application screenshots. Functional importance can be beneficial to infer which elements are the most essential for an application (input fields, buttons etc.) and which are not (for example: advertisement, banner images etc). Using this predicted score, we can create a simplified UI for people with situational and visual impairment.

2. **Research Intern, CMU HCII**
Supervisor: Prof. David Lindlbauer (Augmented Perception Lab, CMU HCII)

(a) **Chameleon User Interface** **September '21 - December'21**
: *Mixed Reality, Geometry Processing, Shape Morphing*

- We aim to reduce visual clutter and distraction in Mixed Reality by camouflaging virtual elements (i.e: changing shape and texture) with nearby environment.
- I implemented a real-time shape morphing and texture synthesis algorithm in unity using barycenteric interpolation.

3. **Summer Geometry Institute Fellow, MIT CSAIL** **July '21 - August '21**
: *MIT Geometric Data Processing group (acceptance rate: 5.58%)*

(a) **3D Shape Correspondence via Probabilistic Partial Synchronization of Functional Maps and Riemannian Geometry**
Supervisors: Prof. Nina Miolane (UC Santa Barbara) and Dr. Tolga Birdal (Stanford) *[Technical Report]*
: Shape Correspondence, Riemannian Optimization, Permutation Synchronization

- We introduce a Bayesian probabilistic inference framework for Riemannian synchronization of functional maps that performs a maximum-a-posteriori (MAP) estimation and deploys a Riemannian Markov-Chain Monte Carlo sampler for uncertainty quantification.
- I led the experiments by curating the dataset of functional maps, implementing MAP and evaluating the accuracy through vertex-to-vertex mapping.

(b) **Self-similarity loss for shape descriptor learning in correspondence problems**
Supervisor: Dr. Tal Shnitzer (MIT) *[Technical Report]*
: Shape Correspondence, Deep Learning, Self-supervised Learning

- We aim to improve symmetric correspondences in deep functional maps by introducing self-similarity loss.
- I implemented and proposed a method of contextual loss computation that calculates symmetric ambiguity in self-supervised method.

(c) **Anisotropic Schrödinger Bridge**
Supervisor: Prof. Justin Solomon (MIT)
: Optimal Transport, Sinkhorn Algorithm

- We developed a discrete schrödinger bridge for anisotropic heat diffusion by posing it as optimal transport problem.
- I implemented the heat kernel and anisotropic laplacian operator for adding path constraint.

4. **Research Assistant, Tero Labs**
Supervisor: Dr. Nazmus Saquib

(a) **Embodied Graph Analytics [Github]** **October '20 - April '21**
: *Sketching Interface, Embodied Mathematics, Graph Analytics* *Accepted at CHI '22*

- We design and implement a framework that allows seamless construction and direct manipulation of graphs and associated analytics on top of images and videos using advanced image processing and computer vision algorithms.
- I led the design and development of our system using geometry processing and image processing algorithms following user-centric design principle.

5. **Undergraduate Research Assistant, BUET**
: *Bangladesh University of Engineering & Technology*

(a) **Review4Repair: Code Review Aided Automatic Program Repairing [pdf]** **April '19 - May '20**
Supervisor: Prof. Anindya Iqbal (BUET) *Published in Information & Software Tech.*
: Program Repair, Natural Language Processing

- We, for the first time, aim to generate code changes (i.e, to fix programming bugs) by understanding the code review comment written in natural language.
- By integrating code reviewer's instruction into automatic code repair, we boost the state-of-the-art performance by 20.33% in Top-1 prediction and 34.82% in Top-10 predictions compared to prior studies.

(b) **Static and Animated 3D Scene Generation from Free-form Text Descriptions [Preprint] [code]** **February '20 - May '20**
Supervisors: Mr. Nafees Ahmed (Waymo), Prof. Anindya Iqbal (BUET)
: Visual Art, Natural Language Processing, Computer Graphics

- We aim to generate static as well as animated 3D scenes from free-form textual scene descriptions. Our neural architecture exploits state-of-the-art language model as encoder to leverage rich contextual encoding and a new multi-head decoder to simultaneously predict multiple features of an object in the scene. A *non-differentiable renderer* then transfers these features into a 3D scene.

(c) **A Tale on Abuse and Its Detection over Online Platforms, Especially over Emails** **Oct '18 - April '20**
Supervisor: Prof. A. B. M. Alim Al Islam (BUET) *Accepted at NSysS '21*
: Interactive System, Natural Language Processing

- We aim to generate a system which analyzes incoming emails and predicts abusive messages.
- I developed a deep-learning based language model [code] and the chrome extension [code]. Our model can handle grammatical and spelling mistakes both at character and word level.

(d) **Novel View Synthesis from blurred images [Project Page]** **June '20 - March '21**
Supervisors: Mr. Nafees Ahmed (Waymo), Prof. Anindya Iqbal (BUET)
: Neural Rendering, View Synthesis, Image Deblurring

- Our key insight is to utilize neural rendering to jointly remove motion blur artifact using deblurring technique and synthesize novel views from high-dimensional spatial feature vectors. We are using Stereo Blur Dataset for our experimental analysis.

COMMUNITY SERVICE

1. **Reviewer**
   - CHI conference on Human Factors in Computing System, 2024
   - ACM Symposium on User Interface Software and Technology (UIST), 2023
   - NeurIPS Workshop on Robustness of Foundation Model (Ro-FoMo), 2023
   - NeurIPS Workshop on Instruction Tuning and Instruction Following, 2023
   - CHI Late-Breaking Work, 2023
2. **Organizing Committee**
   - Student Volunteer, ISS 2023
   - Publicity SV at UIST, 2021
   - Advising Board Member at BWCSE (Bangladeshi Women in Computer Science and Engineering), 2021-22
   - Batch Representative at BWCSE, 2016-20
   - Student Ambassador at Grameenphone GameJam, 2017

NOTABLE PROJECTS

PocketAid: Medical Assistance App **[Featured Page] [Github]**
Featured as one of the top 12 projects (out of 106) in LearnITGirl, an international mentorship program for international female students.
PocketAid is a medical assistance mobile application that can analyze user-symptoms for disease prediction and provide emergency medical services.

Interactive 3D Interior Design Simulator **[Github]**
Supervisor: Prof. Mohammad Saifur Rahman (BUET)
A 3D interactive interior design tool to explore internal space and how it might be better utilized. The users can navigate around a room and modify furnitures, wall and floor features.

AR_ASL: OCR based reading tool for hearing-impaired people **[Demo]**
Presented in the International Women Hackathon, 2020
AR_ASL converts text to American Sign Language in real-time to help hearing-impaired children in reading their textbook.

Tori: A Mental Health Care Tracker and Chatbot using Machine Learning **[Github]**
First place in the national hackathon, Hack_A_Day, 2018.
A lifestyle monitoring and mental health care application that tracks users' online activity, analyzes signs of depression and communicates with them.

Moodsong: A ChatBot that Responds According to the Emotional State using Image processing **[Github]**
First place in the BUET CSE Fest Hackathon, Cloud Computing Category, 2019.
A chatbot which can communicate with users based on their emotional state. It analyzes the users' facial emotion and suggests user specific genre of songs, memes and jokes depending on the mood of the user.

Hati: Health Awareness Video Game **[Github]**

Selected to be presented as one of top 25 projects in SS12 Maker Fair, 2017.

An android game for children to inspire them to eat healthy food and understand the affects of junk food.

AWARDS

November'21 Technica Hackathon (Research Track): Selected to participate in the largest hackathon for underrepresented genders in the US organized by the Department of Computer Science, University of Maryland at College Park, and The Maryland Center for Women in Computing [Demo]

January'19 BUET CSE Fest Hackathon: Champion in 'Cloud Computing' Category

December'18 Banglalink SDG Hackathon: 1st Runners Up and was offered internship for building a solution to curb plastic pollution

May'18 BUET CSE Fest Inter-University Hackathon: Champion in 'Mental Health' Category

April'18 Anita's Moonshot Codeathon 2018: Special Mention for an Augmented Reality application to help women raise awareness against different kinds of vaginal infection (Top 8)

March'18 MobilPro 2018: I was selected for the 5th international competition organized by the Faculty of Electronics, Telecommunications and Information Technology, Bucharest, Romania

March'18 Internationally Featured Project in "Learn It, Girl", Third Edition (Top 12 out of 106). I was the only participant selected from Bangladesh as well.

December'17 Banglalink Ennovators 2017: Finalist and was offered internship for building an application to support women empowerment (Top 20)

December'17 Hackathon for Environmental Migrants: I was selected to participate in this specialised hackathon organized by Dr. Ingrid Boas, Assistant Professor at the Environmental Policy Group, Wageningen University and BBC Media Action

TECHNICAL SKILLS

- **Programming Language:** Python, Java, C, C++, C#, Shell, HTML, CSS, Javascript, Matlab, Intel 8086 Assembly Language
- **Framework:** Pytorch, Pytorch3D, Tensorflow, Geomstats, Pymanopt, OpenCV, OpenGL, Three.js, AR.js, Nuget, Mathematica
- **Tool:** LangChain, Blender, Unity, Vuforia, Android Studio, Firebase, Google Chrome App Engine