FARIA HUQ

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RESEARCH INTEREST

- Creative Toolkit Design
- Human-in-the-loop LLM agents
- Personalized LLM agents
- Autonomous and in-context Web Agent

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) **DreamStruct: Improving Structured Visual Understanding with Programmable Generative Semantics**   **Oct '23 - Feb '24**
   🏷 : *LLM for Data Generation, Visual Understanding*   *Submitted for ECCV' 24*

   - Modeling structured visuals like presentation slides and user interfaces enables the system to achieve better content accessibility and layout adaptability, but traditionally requires extensive manual data collection and annotation, a process exacerbated by the need to relabel datasets for new downstream tasks. We propose a method that uses code to generate synthetic visuals with built-in labels, cutting down manual effort and enabling flexible dataset creation. This approach allows for adaptive training of models on minimal examples. The improvements are demonstrated in three areas: (i) recognizing individual elements, (ii) summarizing overall visual contents, and (iii) classifying the types or purposes of the views.

   (b) **Noteeline: Personalized and Contextualized Note-taking Tool**   **October '23 - Present**
   🏷 : *LLM, In-context Learning, User Modelling*   *In preparation for UIST' 24*

   - 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 developed a novel note-taking tool that enables *micro-note taking* and expands comprehensive notes tailored to the individual's writing style. We propose a novel interaction strategy called 'onboarding session' to model user-specific writing style for in-context learning.

   (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.

2. **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.

3. **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.

4. **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
3. **Mentorship and Outreach**
   - Note-taking Tool: Abdus Samee
   - User Goal alignment for LLM agent through dialog interaction: Nazmus Sakib, Protoy Barai
   - Multilingual LLM agent: Abir Muhtasim, Arnob Bhattacharjee

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, FastChat, Geomstats, Pymanopt, OpenCV, OpenGL, Three.js, AR.js
- **Tool:** LangChain, Blender, Unity, Vuforia, Android Studio, Firebase, Google Chrome App Engine