Alok Singh

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Summary

AI researcher and engineer with expertise in developing and deploying scalable, production-ready machine learning solutions (LLMs, deep learning, multimodal data) using PyTorch and TensorFlow, passionate about applying cutting-edge AI to educational assessment and language learning

Research Interests

Data Science, Multimodal machine learning, Deep Learning. Natural Language Processing (NLP), LLMs, Video & Image Captioning, Information Retrieval, Transformer-based models (BERT, LlaMa), Geospatial Data Analysis.

Education

- **National Institute of Technology Silchar** — Assam, India
  PhD, Computer Science and Engineering — *July 2019 - Aug 2022*
- **National Institute of Technology Silchar** — Assam, India
  M.Tech, Computer Science and Engineering; 8.88/10 CGPA — *July 2017 - May 2019*
- **Uttarakhand Technical University** — Uttarakhand, India
  B.Tech, Information Technology; 7.39/10 CGPA — *Aug 2012 - May 2016*

Experience

- **University of Oxford (Sustainable Finance Group)** — Oxford, United Kingdom
  Postdoctoral Research Associate in Machine Learning and Data Science — *Nov 2022 - Present*
  - **ML and NLP for building Asset-Level Spatial Finance Database for - IKEA Project (2022- Present)** :
    - Utilized Python Selenium for scraping structured and unstructured data from heterogeneous sources.
    - Developed and deployed an end-to-end Retrieval-Augmented Generation (RAG) pipeline with open-source LLMs for advanced information extraction and prompt engineering.
    - Designed a s-BERT-based ranking system to optimize query-driven information retrieval, enhancing data extraction accuracy
  - **KG-RAG + Text-to-Cypher for Nature Finance- (2022- Present)** :
    - Built and deployed a domain-specific Knowledge Graph on GCP for Nature Finance and a KG-RAG system using LangChain and neo4j for context-aware retrieval.
    - Fine-tuned Instruct LLMs for Text-to-Cypher over the knowledge graph.
  - **Satellite Imagery Object Detection and Segmentation for Asset Identification - IKEA Project (2022-Present)** :
    - Developed deep learning models for object detection and segmentation in satellite imagery, aimed at accurately identifying and segmenting assets.
  - **ML for Decarbonizing Agriculture Sector - Barclay Project (Project Lead) (2022- Present)** :
    - Built a comprehensive data wrangling pipeline for scraping, matching, preprocessing, and duplicate removal across diverse sources.
    - Collaborated with project stakeholders to iteratively refine data extraction and retrieval models in an agile development cycle.
    - Utilized geospatial data for unsupervised ML based mapping of farms with the owners, enabling precise farm-level carbon emission calculations and enhancing data-driven decision-making.
    - Regularly interacted with external partner to gather requirements, adjust data mapping strategies, and align technical solutions with operational needs

Research Activities

- **Centre for Natural Language Processing, NIT Silchar** — Assam, India
  Research Assistant - Dr Thoudam Doren Singh *and* ***Prof. Sivaji Bandyopadhyay*** — *July 2019 - August 2022*
  - **Multilingual Video Captioning**: Designed a **deep learning model** to generate concise natural language captions for actions and events in images and videos, bridging the gap between **computer vision** and **NLP** in a multilingual context.
- **Computer Vision Lab, NIT Silchar** — Assam, India
  Research Assistant- Dr Dalton Meitei Thounaojam — *July 2017- May 2019*
  - **Temporal Video Segmentation**: Developed a model for **temporal video segmentation**, detecting abrupt scene boundaries while mitigating challenges posed by **illumination changes** and **motion effects**.

Technical Skills:

- **Languages**: Python, R, C, MATLAB
- **Frameworks & Tools**: Pytorch, TensorFlow, NLTK, Keras, Quantum GIS (QGIS), LangChain, LlamaIndex.
- **ML/NLP**: Generative AI, LLM, Multimodality, Transformer and BERT Models, Spacy, NLTK, Scikit-learn, OpenCV
- **Cloud Platforms**: GCP, AWS

Academic Activities

- **Workshop/Conference Organised:** Co-organiser of ClimateNLP 2024/25 workshop inconjunction with ACL 2024/25.
- **Journals Reviewing:** Scientific Reports, Multimedia Tools and Applications, Applied Intelligence, Applied Artificial Intelligence, Imaging Science Journal, Expert Systems With Applications
- **Conference Reviewing:** ICON-2021, ICICSA2023, ICON-2023
- **Talks/Tutorials**
  - Presented a keynote talk at the AMLD conference organised by EPFL in Lausanne, Switzerland on ***"Role of NLP in Climate change"*** [Online!].
  - Presented a talk on ***"Asset Ownership: Mapping Asset level data to companies using NLP"*** at the Natural Language Processing for Sustainable Finance Programme Symposium (University of Oxford). [Online Presentation!]
  - Presented a tutorial on ***"Visual Description Generation: Fusion of Vision and Natural Language"*** in Recent Advance in Machine Translation (RAMT-2021) a workshop organised by NIT Silchar. [Online Presentation!]
- **Students supervision at Oxford University:**
  - College advisor for a group of master's and Phd students at **St. Antony College** University of Oxford.
  - Supervision of 3 Undergrade student on ***Unveiling NLP's role in climate change solutions*** in UNIQ+ Postgraduate Research Internships at the University of Oxford.

Academic Achievements

- Won MSU Shot Boundary Detection Benchmark 2021 challenge organised by Lomonosov MSU Graphics & Media Lab. Team name: NITS-CV-Lab-v1.0 [Results!][Code!]
- Shared Task: VATEX Video captioning - In conjunction with CVPR 2020 [Result!]
- Datasets: MSR-VTT Hindi video description dataset [Available here!] [Baseline model!]

Publications: Journals Papers

- Kushwaha, N., **Singh, A.**, Sheikh, H.A., NATUREKG: A Natural Language Interface to Cypher in Nature Finance.(PNAS 2024) https://dx.doi.org/10.2139/ssrn.5309106 (Under consideration)
- H. A., Sheikh, **Singh, A.**, N., Kushwaha, C., Christiaen, N., Tkachenko, J., Sabuco, B., Caldecott FLAME: Farm-Level Asset Mapping for England. Nature Scientific Data (2025) 10.1038/s41597-025-05521-8
- Meetei, L. S., **Singh, A.**, Singh, T. D., & Bandyopadhyay, S. (2024). Does cues in a video help in handling rare words in a machine translation system under a low-resource setting? Natural Language Processing Journal, 100016.
- **Singh, A.**, Singh, T.D. & Bandyopadhyay, S. "V2t: video to text framework using a novel automatic shot boundary detection algorithm." Multimedia Tools and Applications 81.13 (2022): 17989-18009.
- **Singh, A.**, Singh, T.D. & Bandyopadhyay, S. An encoder-decoder based framework for Hindi image caption generation. Multimed Tools Appl (2021). https://doi.org/10.1007/s11042-021-11106-5
- **Singh, A.**, Singh, T.D. & Bandyopadhyay, S. Attention based video captioning framework for Hindi. Multimedia Systems (2021). https://doi.org/10.1007/s00530-021-00816-3
- Chakraborty, S., **Singh, A.** & Thounaojam, D.M. A novel bifold-stage shot boundary detection algorithm: invariant to motion and illumination. Vis Comput (2021). https://doi.org/10.1007/s00371-020-02027-9
- **Singh, A.**, Thounaojam, D. M., & Chakraborty, S. (2019). A novel automatic shot boundary detection algorithm: robust to illumination and motion effect. Signal, Image and Video Processing, 1-9. [Code!]

Publications: Conference Papers

- D. B., Kampmann, **A.Singh**, N., Khuswaha, C. Christiaen, B. Caldecott. The Spatial Finance Initiative Global Ethylene Production Database (2024)
- Stammbach, D., Ni, J., Schimanski, T., Dutia, K., **Singh, A.**, Bingler, J., & Leippold, M. Proceedings of the 1st Workshop on Natural Language Processing Meets Climate Change (ClimateNLP 2024) inconjunction with ACL2024
- Kampmann,D., Christiaen C., **Singh, A.**, Kushwaha, N., Reece, S., & Caldecott, B.,. (2024). Assessing committed emissions from ethylene production capacity expansion in the petrochemical industry (Under Consideration).
- **Singh, A.**, Singh, S. M., Meetei, L. S., Das, R., Singh, T. D., & Bandyopadhyay, S. (2023). VATEX2020: pLSTM framework for video captioning. Procedia Computer Science, 218, 1229-1237.
- Meetei, L. S., **Singh, A.**, Singh, S. M., Das, R., Singh, T. D., & Bandyopadhyay, S. "Hindi to English Multimodal Machine Translation on News Dataset in Low Resource Setting." Procedia Computer Science 218 (2023): 2102-2109.
- **Singh, A.**, Meetei, L. S., Singh, S.M., Singh, T.D., & Bandyopadhyay, S. An efficient keyframes selection based framework for video captioning. In Proceedings of the International Conference on Natural Language Processing ICON-2021
- Meetei, L. S., Singh, S.M., **Singh, A.**, Singh, T.D., & Bandyopadhyay, S. An Experiment on Speech-to-Text Translation Systems for Manipuri to English on Low Resource Setting. In Proceedings of the International Conference on Natural Language Processing ICON-2021
- Singh, S.M., Meetei, L. S., **Singh, A.**, Singh, T.D., & Bandyopadhyay, S. On the Transferability of Massively Multilingual Pretrained Models in the Pretext of the Indo-Aryan and Tibeto-Burman Languages. In Proceedings of the International Conference on Natural Language Processing ICON-2021
- **Singh, A.**, Meetei, L.S., Singh, T.D., & Bandyopadhyay, S. Generation and Evaluation of Hindi Image Captioning of Visual Genome. In Proceedings of I3CS 2021 https://doi.org/10.1007/978-981- 33-4084-8_7.
- Chakraborty, S., Thounaojam, D.M., **Singh, A.**, Pal, G., ALO-SBD: A Hybrid Shot Boundary Detection Technique for video surveillance System. In Proceedings of ADCOM 2020 (Accepted Rank- B)
- De, P. K., Pankaj, and **Alok Singh**. "A Study of Propagation of Love Waves in an Anisotropic Porous Layer Under Initial Stress." Recent Trends in Applied Mathematics: Select Proceedings of AMSE 2019. Springer Singapore, 2021.

Working Paper

- **Singh, A.**, Kushwaha, N., Sheikh, H.A., Harnessing LLMs for Climate Hazard Information Extraction. 2025