Research Statement

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I am a second year PhD student in Electrical and Computer Engineering Department. My current research revolves around using computer vision models to perform face anti-spoofing. My research is funded by Prof. Vishal M. Patel in the ECE department. I am interested to work in the field of building ML/Vision based systems which are scalable and robust for wide-scale deployment.

My research motto is to explore how to best *implement* and *deploy* vision/ml based systems in real world applications and reciprocate my learnings to others. As the computer vision community is pushing limits to emulate humanlike vision with different architectures(and almost saturated), I believe the next revolution in the field will come from how best we can build more scalable and robust systems for wider audience. At the end of day, we wish the algorithms (we build as AI researchers) to be made into actual products which help the general public. For that to happen, we need to shift our focus from just publishing small incremental results on toy datasets, but instead build good, more generalisable machine learning systems. Nothing would make me as a researcher more happy than to see something I build being deployed in real world, and being used by the general public or other organisations for their benefit. Not only does this give me a satisfaction, but also gives me a sense of my role, as a person contributing positively towards society.

Now to build these systems I understand is not an easy task and requires considerable effort and prerequisite skills. As far as the skills are concerned, here are some of my research highlights which I think would be valuable towards achieving the above mentioned goal:

- I have 6+ years of programming experience, with proficiency in Python, Pytorch, Matlab and C(very basic).
- 4+ years of working in the field of deep learning with a focus on computer vision. Proficient in writing code in Pytorch for both research and project purposes.
- Multiple research experiences spanning over a period of 4 years, with last two years in my undergrad, and next two years as a PhD student at JHU.
- Graduate level understanding of underlying concepts in Computer Vision (deep learning based as well as handcrafted features in the pre deep-learning era). Intermediate to basic understanding of basic machine learning paradigms with good performance in courses pertaining to the subject.
- Prior experience of building working machine learning models for two projects, one was landslide predicting machine, and second was building automated face recognition software for an industry based internship in undergrad.

Apart from the coding skills, I also have research papers backing my technical writing capabilities. Some of which are described in brief below(reverse chronological order):

1. *Anomaly Detection-Based Unknown Face Presentation Attack Detection*, **Y. Baweja**, P. Oza, P. Perera, V. M. Patel. Accepted at IEEE, International Joint Conference on Biometrics, 2020. Link to paper, code. **Got best audience choice presentation award.**

2. *Heterogeneity Aware Deep Embedding for Mobile Periocular Recognition*, R. Garg [1], **Y. Baweja**, S. Ghosh, R. Singh, M. Vatsa, N. Ratha. Accepted at IEEE, International Conference on Biometrics: Theory, Applications and Systems. **Part of undergraduate thesis.** Link to paper, thesis.

3. *A Comparison of Class Imbalance Techniques for Real-World Landslide Predictions*, K. Agarwal, **Y. Baweja**, *8 other authors*, V. Dutt. Accepted at International Conference on Machine Learning and Data Science, 2017. **Built a landslide prediction, arduino module for hilly regions, currently deployed.**

Although my area of expertise doesn't align directly with the aforementioned goal, I am thus looking for something which comes at an intersection of machine learning/vision and systems engineering. As much as I like to perform research and write publications, I believe at the heart of all lies in the source code where all the magic happens. Furthermore, I am a strong proponent of reproducible research and open source argument. I understand that having some experience in systems, would have enabled me to be better suited for the job, but I believe my proficiency in vision/ml based concepts along with my coding skills will help bring something constructive to the project. Needless to say I am ready to learn the systems related concepts required to better contribute to the project.

Some of my academic achievements are also highlighted below:

1. Got selected for ECE fellowship grant for the first year of graduate studies.

2. Got A+ in MLSP, a heavily programming based course

3. Got a paper accepted in top tier biometrics conference in first year of graduate studies, along with best audience choice presentation award.

4. Big fan of Object Oriented Programming, and keen interest in contributing to production level code base, with a focus on ML.

5. TA for the computer vision course in undergrad, also gave a lecture on computational geometry.

6. As part of two research internships in undergrad, both resulted in building a deployable system (landslide prediction and AI based golf cart).

7. Have prior experience in working group based projects, appreciates constructive feedback (bothways).

Quotes:
"Increasing coherence between the technology base used for modeling and simulation and that used for data analytic computing"

[1] equal contribution