I am a second-year MS CS student at Stanford University. I am writing to inquire about the possibility to join Nu for a **Full Time Role as a Machine Learning/Research Engineer**. I graduated from Indian Institute of Technology (IIT) Kharagpur, with a Bachelor's degree (with Hons.) in Computer Science and Engineering in 2017. Then I **worked at Adobe for about two years as a Software Developer and Machine Learning Engineer** before starting my MS at Stanford. My interests are centered around Deep Learning and its applications in Computer Vision (and NLP to some extent).

I have been fortunate to work with Prof. Stefano Ermon at Stanford as a Research Assistant on problems based on Computational Sustainability and Generative Modeling. Some of my works with him got published at **ICLR 2021** (Negative Data Augmentation), **AAAI 2021** (Efficient Poverty Mapping using Deep Reinforcement Learning), and **IJCAI 2020** (Generating Interpretable Poverty Maps).

In our **ICLR 2021** paper mentioned above, to enable a wider range of augmentations, we explore negative data augmentation strategies (NDA) that intentionally create out-of-distribution samples. We show that such negative out-of-distribution samples provide information on the support of the data distribution, and can be leveraged for generative modeling and representation learning. Empirically, models trained with our method achieve improved conditional/unconditional image generation along with improved anomaly detection capabilities. Further, we incorporate the same negative data augmentation strategy in a contrastive learning framework for self-supervised representation learning on images and videos, achieving improved performance on downstream image classification, object detection, and action recognition tasks.

I also enjoy eclectic applications of machine learning to areas like remote sensing, medical imaging, etc. Contrastive learning based self-supervised representation learning requires a good design of data augmentation to work well. Despite the success of data augmentation, the influence of different augmentation schemes has been less studied. My first-hand experience with the critical role of data augmentation in contrastive learning coupled with their lack of application in remote sensing motivated my subsequent research in this largely unexplored domain of satellite imagery. In a paper submitted to **CVPR 2021**, I led a project that seeks to exploit the spatio-temporal structure of remote sensing data by leveraging spatially aligned images over time to construct temporal positive pairs in contrastive learning and geo-location to design pre-text tasks. We noted that though conventional data augmentation strategies have seen great success on traditional vision datasets like Imagenet, they are sub-optimal for remote sensing owing to their different characteristics and our scheme for creating positive pairs provided more complex similarity cues to the model compared to what random transformations can offer.

In another working paper, we propose generic kernels for distribution shift and outlier detection obtained from self-supervised features on ImageNet and show that our method significantly outperforms state-of-the-art methods as well as supervised kernels on a variety of datasets for both tasks.

Visual Commerce and Augmented Reality: I have worked on projects based on (a**) Image-Based Virtual Try-On for fashion** (two workshop papers in ICCV, poster paper in WACV, multiple patents are filed. Has received lot of media attention), (b) **modeling visual cues for fashion compatibility, outfit recommendation and style extraction** (poster publication in WACV, multiple patents are filed). I have also worked on **enhancing digital experience in Augmented Reality based retail apps using state-of-the-art computer vision and machine learning techniques**, which have resulted in multiple international patents and publications (CVPR workshop and ICCV Workshop). One of my works on visual

content-based product retrieval received the **Best Paper award at FFSS-USAD Workshop @ CVPR 2019**.

I would be happy to discuss my experience in more detail and would appreciate an opportunity to work at Allen AI. My foundation in maths, as well as my long-standing interest and aptitude for learning algorithms and computer vision, enables me to be carry out meaningful research in image recognition, scene understanding, and learning representations. Having derived a lot of confidence from my exploits so far, I hope to keep up my consistency with persistent efforts.

I look forward to hearing from you shortly. Below are the links to my CV and Google Scholar.

CV: https://kayush95.github.io/pdfs/kmryshCV.pdf
Google Scholar: https://scholar.google.com/citations?user=gIlnMF8AAAAJ

Below is a summary of my works before coming to Stanford.

At Adobe
At Adobe, my focus areas were Machine Learning and Computer Vision and their applications in Fashion, Digital Marketing and Augmented Reality. I have worked on projects based on (a) Image-Based Virtual Try-On for fashion (two workshop papers in ICCV, accepted in WACV, multiple patents are filed), (b) modeling visual cues for fashion compatibility, outfit recommendation and style extraction (accpeted in WACV, multiple patents are filed). I have also worked on enhancing digital experience in AR-based retail apps using state-of-the-art computer vision and machine learning techniques, which have resulted in multiple international patents and publications (CVPR workshop and ICCV Workshop). One of my works on visual content-based product retrieval received the Best Paper award at FFSS-USAD Workshop @ CVPR 2019.

I also worked on visual content based video retrieval on natural language query and proposed an end-to-end neural network based embedding model for projection of videos and sentences to a joint embedding space (A patent is being filed). Another work of mine involved improving SVM classification via automatic task-specific custom kernel function search using reinforcement learning (accepted in ACM GECCO 2019).

As a developer, I have created a service using a Deep Learning Based Object Detection Method to provide Object Proposals for automatic mask selection in Nimbus (Adobe's cloud-based Lightroom-style photo editor). I was the primary developer for Adobe Stock Add-on for Wordpress and worked on a Creative Cloud Bot for Slack. I also created an Intelligent Stock Plugin for Google Slides as part of the Adobe Stock Hackathon and used NLP techniques to automatically construct queries from an author's content to be used for retrieving relevant assets from Adobe Stock.
Due to my prolific contributions, I was promoted to Senior Member of Technical Staff two cycles ahead of the normal promotion period.

Undergraduate Summer Internships
In summer 2016, I interned at Big Data Experience Lab, Adobe Research where I worked on Augmented Reality for Enterprise. I worked as part of a close-knit team of researchers from different disciplines. The work resulted in three patents being filed in US and a poster publication in ISMAR 2017. Prior to this (Summer 2015), I worked at Indian Institute of Science, Bangalore where I worked on Saliency Prediction and Salient Object Segmentation. Our model, DeepFix, later won the Large Scale Scene Understanding

Challenge 2016 (held in conjunction with CVPR 2016). DeepFix has also been accepted for publication in the IEEE Transactions on Image Processing journal.

Undergraduate Research

I worked on a project titled "*Generative Adversarial Learning for Reducing Manual Annotation in Semantic Segmentation on Large Scale Microscopy Images*", as my undergraduate thesis under Prof. Pabitra Mitra, which has been accepted in Computer Vision for Microscopy Image Analysis (CVMI) workshop - CVPR 2017 and has also received the best undergraduate project award in the graduating batch of the Dept. of Computer Science & Engineering.

I have been fortunate to work with a variety of faculty on interesting projects during my undergrad. I have worked with Prof. Sandip Chakraborty on *Supporting Throughput Fairness in IEEE 802.11ac Dynamic Bandwidth Channel Access*, which has been accepted as an oral paper in IEEE LCN 2017 . Prior to this, I have worked with Prof. Pawan Goyal on applying conditional random fields to extract information from scholarly articles (OCR++). This has been accepted as a poster in Coling 2016.