Portfolio

Umer Zeb Khan

14031191

Dr. Junaid Akhtar

Acknowledgements

First of all, I am grateful to Almighty Allah, who helped me persevere and persists in the face of hardships and turmoils. Followed by my dedicated group of companions and friends who pushed me literally to achieve what I so easily would have given up on. Without you, I would not be here, thank you.

This prose shall remain incomplete without expressing my gratitude to Dr. Junaid Akhtar for his unconventional yet charismatic and insightful mentorship throughout the course of this year long project. I am humbled, and shall remain forever indebted.

A faithful thanks to my parents who deserve acclaim for putting up with my tantrums, and whose sincere prayers and well wishes has propelled me to achieve great things. They shall always remain my shimmering light.

Last but not the least, to all the marvelous individuals that remain anonymous on stackoverflow and other internet communities working hard and out of passion to help advance the scientific cause and the people who write tutorials, and make exhaustive youtube videos to make knowledge sharing easy. It is truly impossible to progress without the intellect and genius of such contributors. Thank you very much, whoever you are and wherever you are.

Table of Contents

1. Introduction

My dear fellows in science, this digitally synthesized piece of documents will enable its reader to witness my personal growth and professional development throughout the course of this final year project via the use of reflective writing. Why does reflection happen to be so significant?
The value of reflective writing is derived from the articulation of an experience into language which aids in crystallising feelings and thoughts (Mccarthy, J., 2011) by provision of distance between the experiences and the thoughts accompanying them. This leads to insights previously not recognized during the experience and is supported by the fact that if an event is followed by its written account and conscious analysis, learning from the event is aided and reinforced (Strivens J., 2009).
The next chapter sheds light on the project plan during both the semesters including Gantt charts, along with identification of main tasks and their self-imposed deadlines. The third chapter consists of meeting minutes in chronological order where every record provides the specifics of the meeting followed by a summary. The last chapter, but not the least, provides insight into personal development in the last eight months, highlighting evidence and snippets of my cv, professional writing and technical skills.
Søren Kierkegaard said, and I quote, “Life can only be understood backwards; but it must be lived forwards”. Hence this document ponders upon what has happened and how it has helped me grow, as a professional and a person. The document is concluded by the last chapter of thoughtful evaluation and reflective analysis of the contents discussed, observed and witnessed. Fig. 1 shows the reflective model proposed by Boud of the three whats: what, now what and so what (Boud, D., Keogh, R. & Walker, D., 1987) and the one employed in this document.

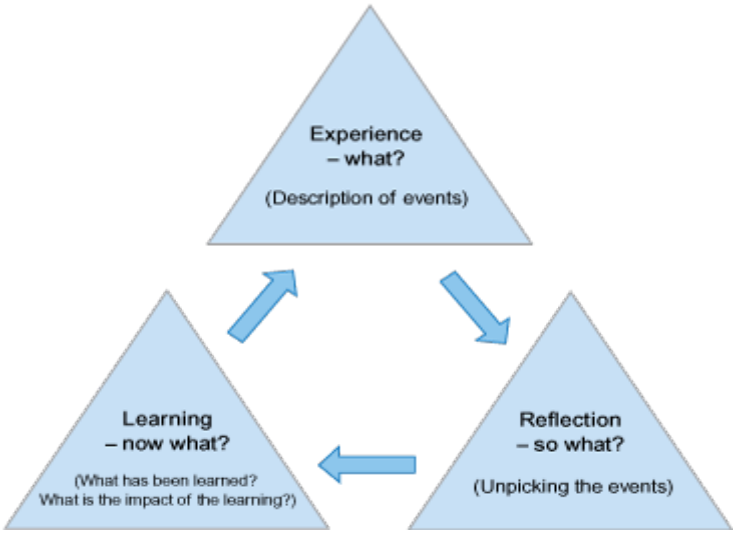


Fig. 1. Reflective Model Process

2. Project Development Plan

This chapter divides into chunks the work of the eight months long project tenatatively and how I fared in executing them. Like the adage goes, if you are failing to prepare, you are preparing to fail. Hence project planning plays an integral part in ensuring its successful completion and allows introspection when deadlines and milestones go awry.
Figure 2 shows a Gantt chart covering the entire duration of project including both the semesters, with major milestones explained further in terms of what they entails, limitations encountered, the rationale behind a decision along with the joys and sorrows experienced.

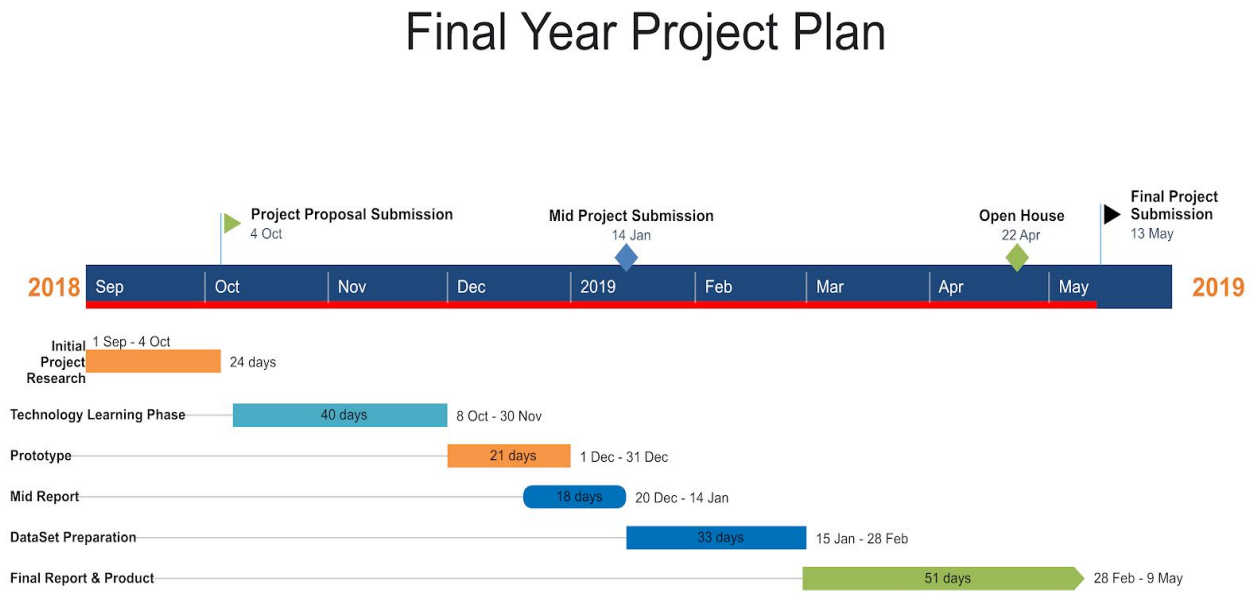


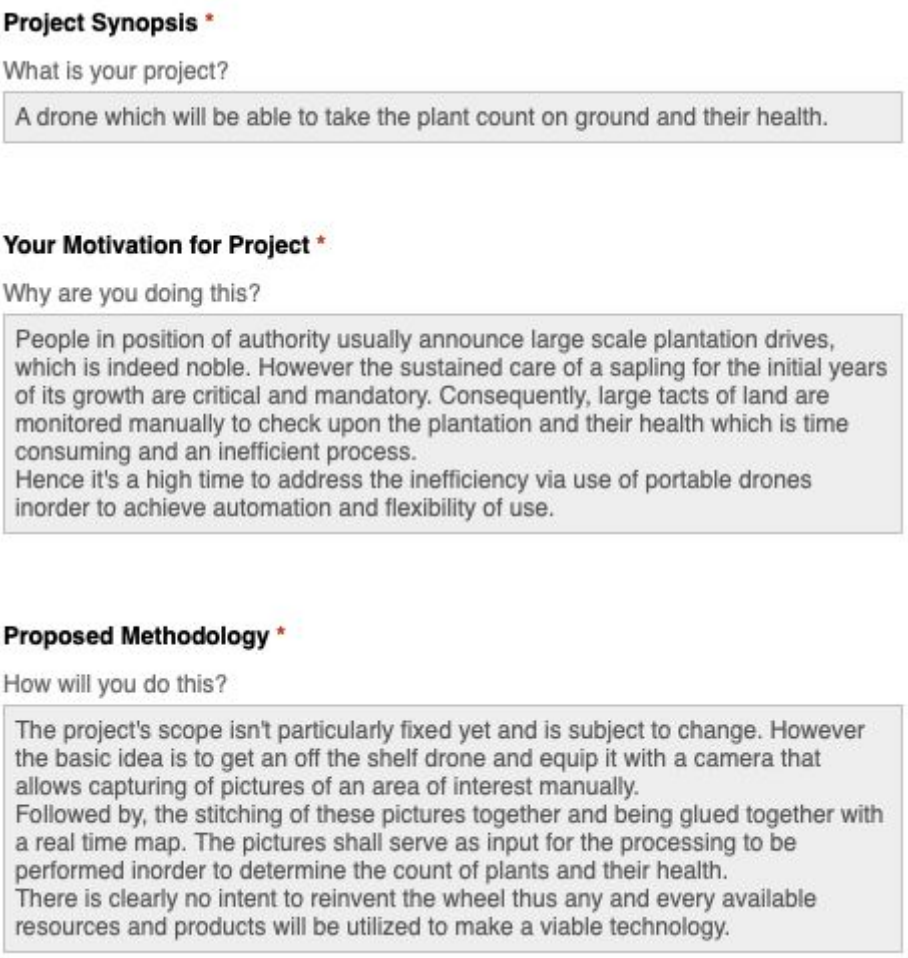
Fig. 2. Project Plan Gantt Chart

2.1. Project Milestones

- ### 2.1.1. Project Proposal Submission (4th October, 2018)

  This milestone demanded the proposal submission in writing hence was preceded by a lot of research, and a great leap of faith in selection of technologies and proposed methodology. Figure 3 displays a snippet of the submitted proposal.
  I started out to work on autonomous cars, specifically using computer vision and machine learning to help maneuver a radio controlled car through road intersections by reading the traffic start/stop sign i.e. red, yellow, green lights to stop, ready and go autonomously.

The project evolved and eventually took the challenge of tree counting since the inception of the 10 billion tree tsunami initiative nationally in Pakistan and off course the utmost importance of trees as valuable contributors to the flora and fauna of a region in this age of climate change and global warming.
Moreover, another significant reason for dropping the initial project idea was the lack of practical application in the context of local deployment and research effectiveness while keeping in view national needs. Additionally, agriculture happens to be the biggest contributor to Pakistan's GDP while employing half of the country's workforce and hence requires innovative technological solutions.



Project Synopsis *

What is your project?

A drone which will be able to take the plant count on ground and their health.

Your Motivation for Project *

Why are you doing this?

People in position of authority usually announce large scale plantation drives, which is indeed noble. However the sustained care of a sapling for the initial years of its growth are critical and mandatory. Consequently, large tacts of land are monitored manually to check upon the plantation and their health which is time consuming and an inefficient process.
Hence it's a high time to address the inefficiency via use of portable drones inorder to achieve automation and flexibility of use.

Proposed Methodology *

How will you do this?

The project's scope isn't particularly fixed yet and is subject to change. However the basic idea is to get an off the shelf drone and equip it with a camera that allows capturing of pictures of an area of interest manually.
Followed by, the stitching of these pictures together and being glued together with a real time map. The pictures shall serve as input for the processing to be performed inorder to determine the count of plants and their health.
There is clearly no intent to reinvent the wheel thus any and every available resources and products will be utilized to make a viable technology.

Fig. 3. Project Proposal on 4th Oct, 18.

- ### 2.1.2. Mid Project Submission (14th January, 2019)

  The milestone required a physical submission of the mid project report and a prototype followed by a demonstration to my project's supervisor and co-supervisor. Till this point, I had acquired the fundamentals necessary to tackle my choice of problem, tree count. Those fundamentals include an understanding of machine learning frameworks, known algorithms, trade lexicons, available pre-trained models and comprehensive datasets.

So far, I had hands on experience of working with Keras, to implement my prototype, where a convolutional neural network was trained on a Cifar-100 dataset to detect five distinct species of trees i.e. maple, oak, palm, pine, willow (*Krizhevsky, A., 2012*). Additionally, I had procured a low budget unmanned aerial vehicle, Ryze Tello Quadcopter with a 5 MP HD camera to capture spatial imagery of trees. I had prepared my own dataset comprising of 126 images varying in their field of vision and elevation angle from the ground. Image collection was followed by annotation of data using labelmg tool. Since the task was physically and mentally taxing, I sought the help of my friends and juniors which is an excellent example of what makes humans unique is their ability to cooperate and communicate at a mass scale.
Dr. Junaid recommended learning about YOLO (*Redmon, J., & Farhadi, A., 2018.*) architecture and its feasibility of application to my problem whereby I concluded it wouldn't be an appropriate choice due to it's compromise on mean average precision (*Hui, J. & Hui, J., 2018.*) for the sake of real time performance and opted for a deep convolutional network like ResNet (*He, K. et al., 2016.*) for it's excellent mean average precision (*Tsang, 2018.*) and high adaptability to my problem.
As can be seen in figure 3, my project proposal included the health monitoring of trees, and now I knew why it was difficult to implement the feature using only a single source of RGB images to extract information that can only be provided using hyperspectral sensors (*Peña, J. et al., 2015.*) to calculate various vegetation indexes i.e. VI, NDVI, to determine water stress level and plant health. An image, as displayed in figure 4, shows work done until the writing of mid report.

I have been reading from various sources and working with introductory machine learning software, algorithms and techniques. One of the first tool recommended for amateur machine learning enthusiasts is a GUI based application called WEKA. Although it's a data mining software, proficient in numerical analysis and text recognition, yet it provides a comprehensive introduction to various machine learning techniques and algorithms in a graphical user interface that makes the fiddling with parameters intuitive and strong visualization make it possible to see the cause-effect relationship between two or more variables/setting.

Another very interesting project I undertook to enhance my understanding of neural networks and the technology I intend to use for my custom problem is the implementation of YOLO (You Only Look Once) on my webcam. The process started with downloading and installing Darknet with CUDA and OpenCV (Redmon, J., 2017). With one simple command, the webcam turned into a real time object detecting device, which was quite fascinating to watch. Throughout the webcam feed, the frames per second are displayed along with bounding boxes over the types of objects detected. In my case, it mostly was my face which resulted in the prediction of person class.

For the purpose of prototype, I was able to find a deep CNN model used with the CIFAR-100 dataset, which includes the superclass of trees able to detect six different types. For a start, it's a great model to learn about how the entire mechanism works. The difference between classification, detection, localization, tracking and template matching was learnt.

Furthermore as my intended work is to detect trees, the model does just that along with many other objects detection. I tweaked with the dataset to include only the tree superclass images, which are roughly 600 in number, but to my dismay the resulting performance although quick, was quite terrible at detecting trees.

In the future, I will have to curate my personalized dataset of images captured via an unmanned aerial vehicle. Along with that, I shall be training my own custom detection model exclusively for trees, mainly following the methods and techniques discussed by Yang, L. et al.,

Fig. 4. Mid Report Screenshot

- 2.1.3. Open House (22nd April, 2019)

  Open house was arranged at Namal College, Mianwali to showcase the final year projects of students to representatives from various software houses, call centers, multinational companies and potential employers. As a result, having a sound knowledge of theory underpinning my project and a demostrable working product with a poster as shown in figure 5, was essential before this milestone.

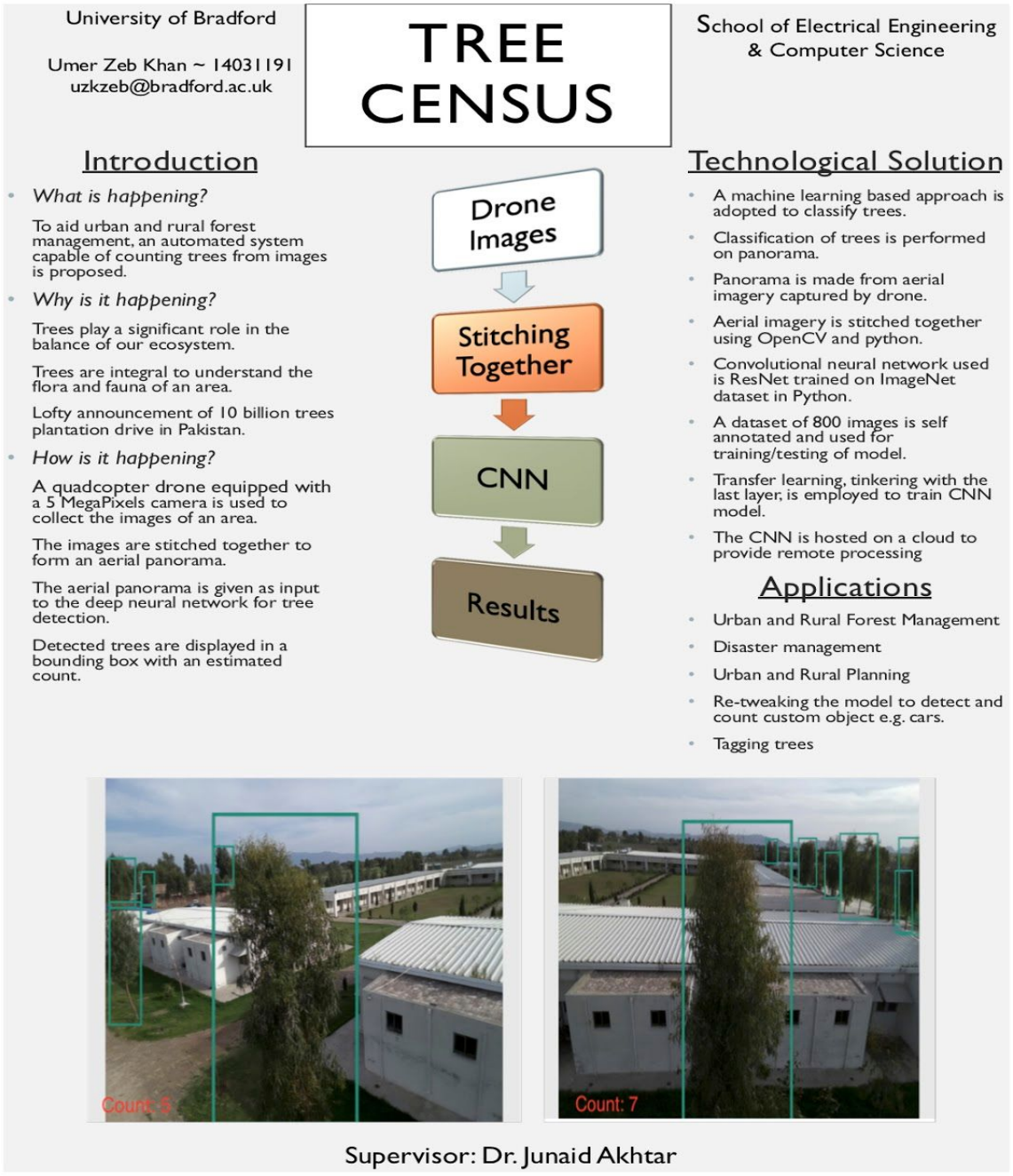


Fig. 5. Poster for Open House

The real challenge was to find a way where in lieu of passing many different images to the neural network for tree identification, just one stitched aerial image (*Brown, M. & Lowe, D.G., 2006.*) is given as input to count trees. Upon successfully achieving the objective of stitching multiple images together, the next step was to stitch together frames of a video together. For this purpose, all the frames from a video were extracted and stitched together (*Li, J. et al., 2014.*) to give one large panoramic aerial shot. A sample shot of a stitched image is displayed in figure 6, where every 10th frame of a 29 seconds video being shot at 30 frames per second was stitched together.

Fig. 6. Stitched Aerial Image

Another detector for trees was trained on a cloud machine learning API called, NanoNets available at nanonets.com. An accuracy of roughly 93 % was achieved in localization of trees which was followed by the count of bounding boxes to give the number of trees. Figure 7 contains some of the details of the neural network.

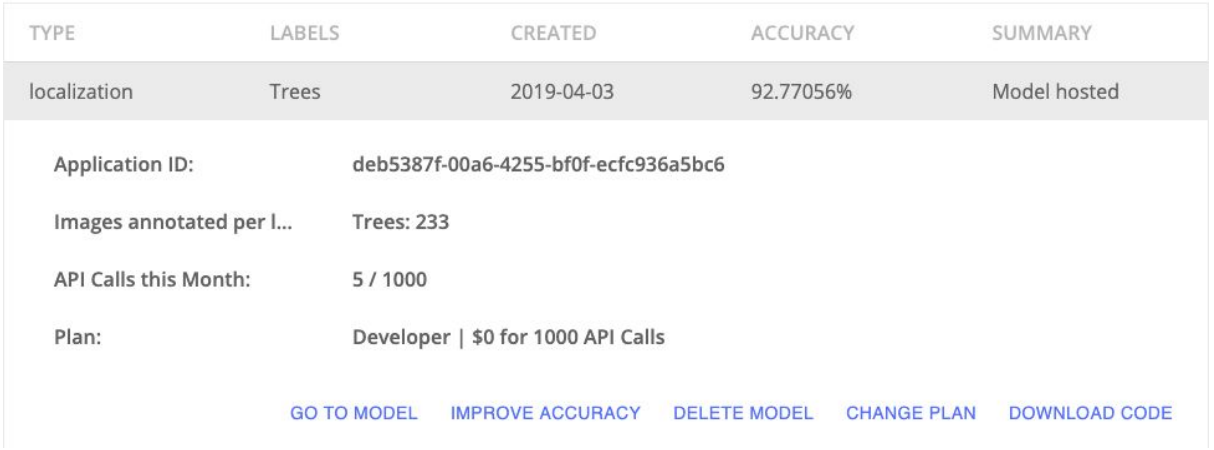


Fig. 7. NanoNets Model Details

- ### 2.1.4. Final Project Submission (13th May, 2019)

  My product was complete and the final report along with this document is underway. I tried fine tuning my model and worked on the suggestion of Dr. Junaid to integrate my cloud model for post processing.

I also took the time to enhance my dataset using data augmentation techniques (*Raj, B. & Raj, B., 2018.*) since it helps prevent irrelevant pattern recognition by the neural network. Initial data of 126 images applied with two major augmentation tactics of axis rotation and filters. The resultant images had three axis rotation: horizontal flips, vertical flips and horizontal-vertical flips, and seven filters applied: sunny, shady, rainy, blur, motion blur, salt & pepper and snowy. Figure 8, 9 and 10 show three result after augmentation. Labels in xml format of initial dataset were preserved of augmented images.

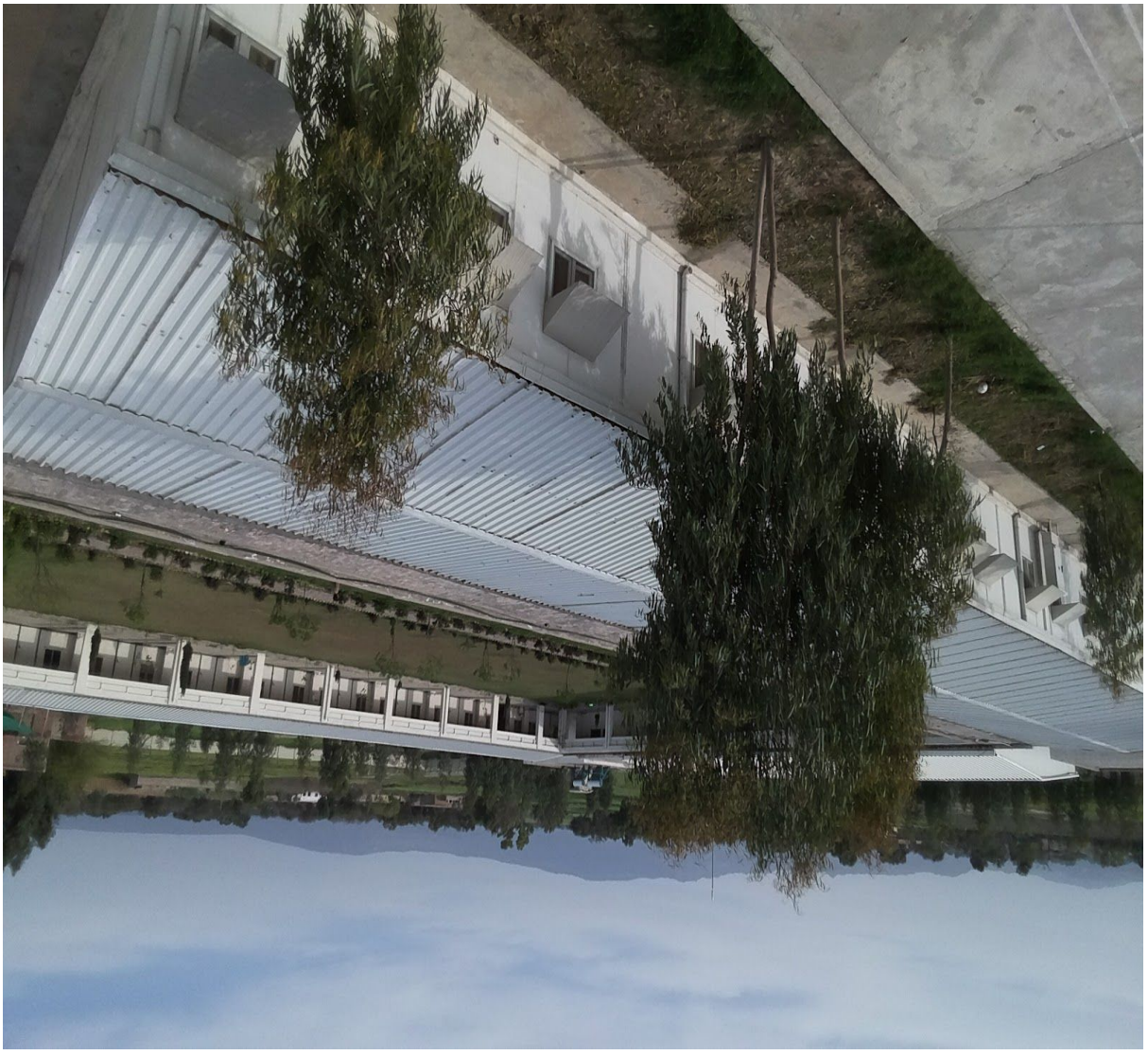


Fig. 8. Vertically Flipped Augmentation

Fig. 9. Salt & Pepper Augmentation

Fig. 10. Motion Blur Augmentation

3. Supervision Meeting Minutes

Meetings with the supervisor were recorded in two phases. The first was scribbling the main agenda and points of discussion during the meeting on paper. The second was uploading on pebblepad which proved to be an excellent tool in keeping track of progress and aiding reflective writing. All the meeting are provided at the end of this chapter as the pdf generated by pebblepad is appended.
Minutes of meeting proved to be an effective tool to manage task allocations and discuss challenges faced in the implementation. My thoughtful discussions with Dr. Junaid were instrumental in the successful implementation of the project. In the previous chapter, it was demonstrated what type of and when deviations did occur from the meeting's agenda. In addition, limitation faced and solution adopted against them are outlined. This chapter and the former one is intrinsically linked.

Minutes of Meetings

Umer Zeb Khan - University of Bradford
Created: 12-MAY-19 **Last Modified:** 13-MAY-19

PebblePad

Contents

The Beginning

Brainstorming with Dr. Naeem Ayaaz

Date: 27-09-2018

Time: 16 00 hours till 16 45 hours

Venue: Guestroom

SUMMARY

Different technical ideas were discussed, with their potential and scalability debated. Professor Ayaaz recommended two domains for the FYP, as assessed by World Economic Forum, in-demand in 2020; Data Science and Machine Learning.

Additionally, he stressed over a clear proof of concept of any problem I ultimately choose to solve. Every computation has three main steps: Input, Processing & Output. Where the output, or end result, should be as a beautiful/interactive visualization. For this purpose, Dr. Ayaaz recommended a statistical data visualization package called GGplot2.

As an introduction to machine learning algorithms, WEKA, a Java based data analysis tool was recommended to learn the fundamentals of the trade.

Proposal Debate

Dr. Junaid Akhtar

Date: 28-09-2018

Time: 16 30 hours till 16 38 hours

Venue: Faculty Office

SUMMARY

The meeting was short and concise where discussion pertaining the project's scope was undertaken and how should the work commence. I was recommended several things:

- Drop autonomous flight planning
- Focus on data collection and processing
- Link with nationwide Billion tree tsunami project
- Plant count and Plant health should be implemented
- I requested supervisor if there was any specific reading material

Following up

Dr. Junaid Akhtar

Date: 10-10-2018

Time: 15 30 hours till 15 45 hours

Venue: Faculty Office

SUMMARY

I followed up on my prior meeting and seeked comments on my initial research. Advisor to the prime minister on climate change had requested for individuals to take upto task the actual count of trees planted under the Billion Tree tsunami project.

Dr. Junaid recommended object classification that is able to classify a single class from a single image in-order to tackle the problem of identification first followed by count. For every problem, start with the most basic hypothesis and increase complexity gradually.

Additionally, I was tasked with researching the types of drone and the cameras accompanying them, and how all of it affects my specific problem of counting. Moreover, the YOLO algorithm was to be researched thoroughly.

Discussion over a board game

Dr. Syed Asad Alam and Dr. Malik Jehan Khan

Date: 10-10-2018

Time: 15 50 hours till 16 00 hours

Venue: Faculty Lounge

SUMMARY

After meeting with my supervisor, I stumbled upon my co-supervisor, Dr. Jehan and my teacher, Dr. Alam, playing a game of karem whereby I decided to join them.

During the course of game, I explained what I had in mind to solve the problem and the lack of highly quality open source data. Dr. Jehan shed light on segmentation and linked my problem of detection to a coursework we would undertake in one of our modules, Neural Networks and Fuzzy Systems regarding cancerous cells segmentation.

Dr. Alam strongly suggested I curate my own dataset and label them, while starting as early as I could since manual hand annotation was a cumbersome and long process. Which reminds me of GIGO: Garbage In, Garbage Out.

A long meeting before mid evaluation

Dr. Junaid Akhtar

Date: 27-12-2018

Time: 16 30 hours till 17 05 hours

Venue: Faculty Office

SUMMARY

I had a long list of questions and queries which are given below, hence this meeting was longer than usual.

- What's expected out of a final year project?
- How deeply and well am I supposed to know how my project functions?
- What are the expectations from prototype?
- How can I classify my project? Development or Research?
- Should I use a pre-trained model?
- Use an already curated dataset or self-captured aerial imagery?
- My problem doesn't demand a real time solution, should I still use YOLO that makes a tradeoff of accuracy for speed?
- How can count be displayed as an end product? GUI?
- What's the preferred frequency and mode of communication? Should minutes of meeting be shared?
- When you dig into the heart of machine learning, a lot of mathematics exist. How well am I expected to know all of it?
- If another model is trained, should classification take place on custom objects only?
- How would the problem of re-identification be solved if a video is taken as input?
- What budget do I have for a drone? A vision operated or GPS one? With a mechanical or digital gimbal? What angle of imagery/video is preferred?

So it's evident, a lot had piled up and it was a rich meeting. Dr. Junaid provided insightful answer to many of my queries and safe to say, I left with as many question, if not more, as I came in with. No frequency of meeting was set and it was left subject to my will and discretion with my project being a mixture of both, development and research.

I was tasked to meet Sunnan, another student being supervised by Dr. Junaid who shared the same project domain as mine and talk about transfer learning and adjusting weights of the last layer. Additionally, to remove the many temporal redundancies and re-identification issues, I was recommended to stitch the video together to form a single panoramic image.

Walking along the arch

Dr. Junaid Akhtar

Date: 13-02-2019

Time: 12 10 hours till 12 25 hours

Venue: Outdoor Lobby's Arch

SUMMARY

The progress so far was discussed and the detection performance of trees after being trained on 30, 000 images from the Pasadena Urban Trees dataset where roughly an accuracy of 76 % was reported.

The next step was to count trees on self captured aerial imagery, starting from a single image to many that have been stitched together. To solve the count problem, a unique color pigment is dropped on the tree crown of every detected tree which is then counted by a python script.

Sharing dismal performance problems

Dr. Junaid Akhtar

Date: 06-03-2019

Time: 16 50 hours till 17 10 hours

Venue: Faculty Office

SUMMARY

After the introduction of self captured drone images, the performance of detecting trees dropped drastically and I could not explain why. Suggestion was given to improve quality of dataset and include more self captured drone images while working on post processing to improve results.

Additionally, Dr. Junaid asked for the type of images in my dataset and to share sample of each with him via email. Furthermore, to resolve the re-identification problem, a drone video should be made whose frames are extracted and then stitched together using a robust sticthing algorithm.

Product discussion prior to Open House

Dr. Junaid Akhtar

Date: 16-04-2019

Time: 16 10 hours till 16 35 hours

Venue: Faculty Office

SUMMARY

I presented my limitations of the project and sought suggestions on how to improve them. My custom trained deep convolutional neural network classified a bunch of trees as a single tree. Whereby I was asked to pass the output of one neural network to the other for double detection. In hindsight, my supervisor was only pulling my leg.

Moreover, I was further asked to enhance my dataset and improve its quality by introducing variations and better lighting conditions. Additionally, image stitching had to be done before open house demonstration.

I sought tips on poster presentation and design along with how should a project be pitched ideally. Dr. Junaid sheds light on yet another excellent application of my project in the domain of disaster management, specifically wildlife fires and the damage it causes to trees.

Post-Final Presentation talk

Dr. Junaid Akhtar

Date: 10-05-2019

Time: 12 10 hours till 12 25 hours

Venue: Faculty Office

SUMMARY

During the course of my final presentation, I was asked to demonstrate the result of my neural network hosted on cloud but due to nervousness, I logged onto the wrong account. I quickly figured my error and met my supervisor to show the result.

He was pleased, however I was recommended to complete the cloud solution by integrating the code and including some post processing. A day before the presentation, I asked him for suggestions regarding an ideal presentation. Whereby his reply was, and I quote, '**a man or his work should always be better than his cv or presentation**'.

4. Personal Development Plan

This chapter deals with my personal growth and development plan during the course of this project. My skills of time management, priority setting and cost-benefit analysis of decisions has improved dramatically. Several pieces of evidence are attached to highlight progression including cv, email screenshots and presentation preceded by a summary.

4.1. CV

Additionally, three iterations of my cv are attached below to draw attention to the difference between them not only in content but style, structure and format. The first cv was made in the foundation year as a module assignment.
The second was yet again for an assignment of the module Developing Professional Skills. The template used was recommended by the module's instructor and paints a stark comparison from the first one apart for the obvious same picture. Final iteration was done on Open House to make it more visually appealing and correct using the typewriter tool, Latax. Only relevant details were included. Use of linkedln has provided me with an excellent feature to generate an updated resume whenever necessary, which is attached at the last.

UMER ZEB KHAN

- Home town: Bannu, KPK, Pakistan
- Current address: 41 km, Talagang road, Namal college hostel, Chagdah, Mianwali
- Date of birth: 14th December, 1994
- Nationality: Pakistan national
- Contact numbers: 1) 0333-5375757
  2) 0459-236995
- Email address: umerzebkhandurrani@gmail.com

SUMMARY

Logical and rational thinking, self-confidence and hard work are the foremost qualities to be successful in any field of life, which I possess and have the power to exercise. Been graciously given the opportunity to travel a lot, I firmly believe to have the necessary experience and skill to deal with people from different spheres of life, at home and abroad. Apart from being continuously amazed by electronics, I have been an active participant in debates and speeches, bringing home honors from many notable competitions. I, for one, think that public speaking instills the quality of confidence and self-acceptance in us, which is an essential ingredient for the recipe of success.

Let me conclude by saying, facing challenging situations with determination and emerging out of them with progressive results has been my aim in every aspect of life. I have been quite successful at it thus far, intending the same in times to come, only if given an opportunity.

SKILLS AND STRENGHTS

Languages

· Pashtu – Fluent Speaker (Mother tongue)

· Urdu – Fluent Speaker/Writer

· English – Fluent Speaker/Writer

· Punjabi – Speaker

· Having a sound knowledge of computers, how to operate and interact on them

· A knowledge of computer programs like Microsoft Word, Excel, Access etc.

EXTRA CURRICULUM ACTIVITIES

- Parliamentary Debater – within School and at regional level
- An excellent horse rider with 4 years' experience of playing Polo
- Swimming, tennis, basketball, football are few of the physical activities I've engrossed in
- Having a vast experience of event management i.e. chief organizer of college events
- Participated and secured flying colors in honorable competitions such as SOFTEC, PSIFI, MUN's held at prestigious universities and colleges e.g. Fast, Nust, Lums, Bss, Tcs etc.

EDUCATION

2014-18	**Bachelors in Electrical and Electronic Engineering,** *University of Bradford.*
2014-12	**General Certificate of Education (GCE) Advanced Level,** *Bloomfield Hall Upper school, Bahawalpur.* Majors in Physics, Chemistry and Mathematics
2010-12	**General Certificate of Education (GCE) Ordinary Level,** *Bloomfield Hall Upper School, Bahawalpur.* Majors in Physics, Chemistry and Computer Studies

REFERENCES

- Name: Muhammad Faizan
  Designation: Lab Instructor – Department of Computer Science
  Email: muhammad.faizan@namal.edu.pk
- Name: Muhammad Asif
  Designation: Lecturer – English Language Centre
  Email: muhammad.asif@namal.edu.pk

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PERSONAL INFORMATION

Umer Zeb Khan

House # 6-D/1, Street 2, Model town A, Bahawalpur, 63100.

92-62-2881129 92-333-5375757

Umerzebkhan@hotmail.com & Umerzebkhandurrani@gmail.com

WhatsApp 92-333-5375757

Sex Male | Date of birth 14/12/1994 | Nationality Pakistani

EDUCATION AND TRAINING

Spring, 2019

Bachelor of Computer Science with Honours

University of Bradford, UK.

- Computer Architecture & System Software
- Symbolic & Declarative Computing / Artificial Intelligence
- Software Engineering with Group Project
- Data Structure & Algorithms
- Database System
- Computer Communication & Networks
- Developing Professional Skills
- Fundamentals of Internet Technology
- Formal Foundation

Spring, 2014

General Certificate of Education Advanced Level

University of Cambridge, UK.

- Physics
- Chemistry
- Mathematics

Spring, 2012

General Certificate of Education Ordinary Level

University of Cambridge, UK.

- English
- Urdu
- Mathematics
- Pakistan Studies
- Islamiat
- Computer Science
- Physics
- Chemistry
- Sociology

PERSONAL SKILLS

Highly empathetic & commendable EQ

Mother tongue(s) Pashto

Other language(s)

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	

europass Curriculum Vitae Umer Zeb Khan

English	C1/2	C1/2	C1/2	C1/2	C1/2
	IELTS. 8 bands.				
Urdu	C1/2	B1/2	C1/2	C1/2	B1/2

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

Communication skills

- Being the son of army personnel, travelling was extensive and meeting new people inevitable. Hence I possess strong communication skills across varying domains.
- Being the correspondent of emails for my college, I advised and wrote replies to queries, allowing me to solidify my written communication.

Organisational / managerial skills

- Director Trips & Event for my college's Adventure Club, whereby I lead a team of 4 individuals to plan and execute trips throughout the country.
- Director Event for my college's Literary and Debating Society, whereby I lead a team of 10 individuals to organize and execute literary galas and competitions.
- Chief Editor for my college's magazine, delegated with the responsibility of curating, editing and publishing an annual magazine and bi-monthly publications via electronic and print media.

Job-related skills

- Good command of small-scale business cash influx and automated processes.

Computer skills

Comfortable with using Microsoft Office™ tools.
- Acquainted with several programming languages and proficient in a few e.g. Python, Java, Haskell, MIPS, C++, C

Other skills

- Passionate about automobiles i.e. junior administrator of Pakwheels.com
- Neuro Linguistic Programmer – Level 1

ADDITIONAL INFORMATION

Publications

Publications in reputable national and international print media i.e. Dawn, The Nation, Huffington Post, Medium.

Seminars

- How to write a successful CV, Namal College, Mianwali, 2017
- Communication Skills through NLP, Dr. Moiz Hussain, Islamabad, 2012

Projects

- Pro-life chat application. Principal architect in charge of design, partial development and documentation (Dec, 2017-April, 2018).

Honours and awards

- Best Delegate, LUMUN (2016)
- Best Written Proposal, NIMUN (2017)

Memberships

- All Pakistan Polo Club
- Kectill Youth Leadership Programme

References

A general reference is attached. Tailored recommendations can be provided upon request.

ANNEXES

Reference

Dated: October 27, 2017

To Who It May Concern

It is certified that **Umer Zeb Khan** is a bona-fide student of Namal College, Mianwali. I have known him personally since 2015 in the capacity of English Teacher and Patron, Literary and Debating Society. I also taught him Developing Professional Skills. For me, he is amazingly innovative and commendably creative. He is very keen learner and efficient worker. He has been serving Literary and Debating Society as Event Director since September, 2015. He is editor of Namal Magazine and Newsletter. He has proved his leadership qualities and got acknowledgement as a true team man. I firmly believe that he is an ideal choice for KECTIL Youth Leadership Programme. It is his ruling passion to excel in his field. He never leaves any stone unturned to achieve his target and his amazing grip on English is a big plus. His IETLS score of 8.5 bands is self-explanatory to his brilliance in English. He got the award of best delegate at MUN held at LUMS in 2016. He has consistently proved his leadership qualities in all curricular and co-curricular activities and through his contribution to Literary and Debating Society. I personally rank him very high and wish for his bright future.

Muhammad Irfan Nadeem
Senior Lecture in English
Patron, Literary & Debating Society

UMER ZEB KHAN

Final Year Student

@ uzkzeb@bardford.ac.uk @ umer2014@namal.edu.pk 0333-5375757 Pakistan inkedin.com/in/Umerzebkhan
github.com/Umerzebkhan

EXPERIENCE

Summer Internee

PSO (Pakistan State Oil)

July 2017 – August 2017 Bahawalpur, Pakistan

ACHIEVEMENTS

- Best Delegate, LUMUN (2016)
- Best Written Proposal, NIMUN (2017)
- Top Quarter of my class since 7th grade
- League Horseback Polo Player
- I have taught myself 5 languages.

SKILLS

Java, Python, Keras, Tensorflow, Pytorch ●●●●●
Technical / Scientific Writing, Academic Research ●●●
●●

EDUCATION / COURSES

Communication Skills through NLP

3-days seminar by Dr. Moiz Hussain

June 2017 Pakistan

Bachelor of Computer Science with Honours

University of Bradford

2015 – 2019 UK

General Certificate of Education Advanced Level

University of Cambridge

2012 – 2014 UK

General Certificate of Education Ordinary Level

University of Cambridge

2010 – 2012 UK

HONORS & AWARDS

- Received accolades at FAST for Best Individual Project.
- SAT result lie in 97th percentile.
- Publication in Dawn, The Nation, Huffington Post, Medium.
- Chief Editor of College's Newsletter

PROJECTS

ProLife

- A group project of 4 people requiring active collaboration.
- Android based app to connect people using text messages and interactive media.

Tree Cataloguing

- Developed, modified and implemented robust object detectors to count trees by combining 3 different types of motion and appearance information to learn deep association metrics.

Contact

03335375757 (Fax)
umer2014@namal.edu.pk

www.linkedin.com/in/umer-z-002255135 (LinkedIn)

Top Skills

Microsoft Office
Research Writing
Machine Learning

Umer Zeb Khan

Student at University of Bradford
Pakistan

Summary

My mantra for life is thinking without the box altogether.

I remain passionately curious and happen to be an avid learner.

Horse riding and reading are my indulgence of choice.

Thank you for peaking.

Experience

Pakistan State Oil
Summer Intern
July 2017 - August 2017 (2 months)
Bahawalpur, Pakistan

Education

University of Bradford
Bachelor of Science with Honours, Computer Science · (2015 - 2019)

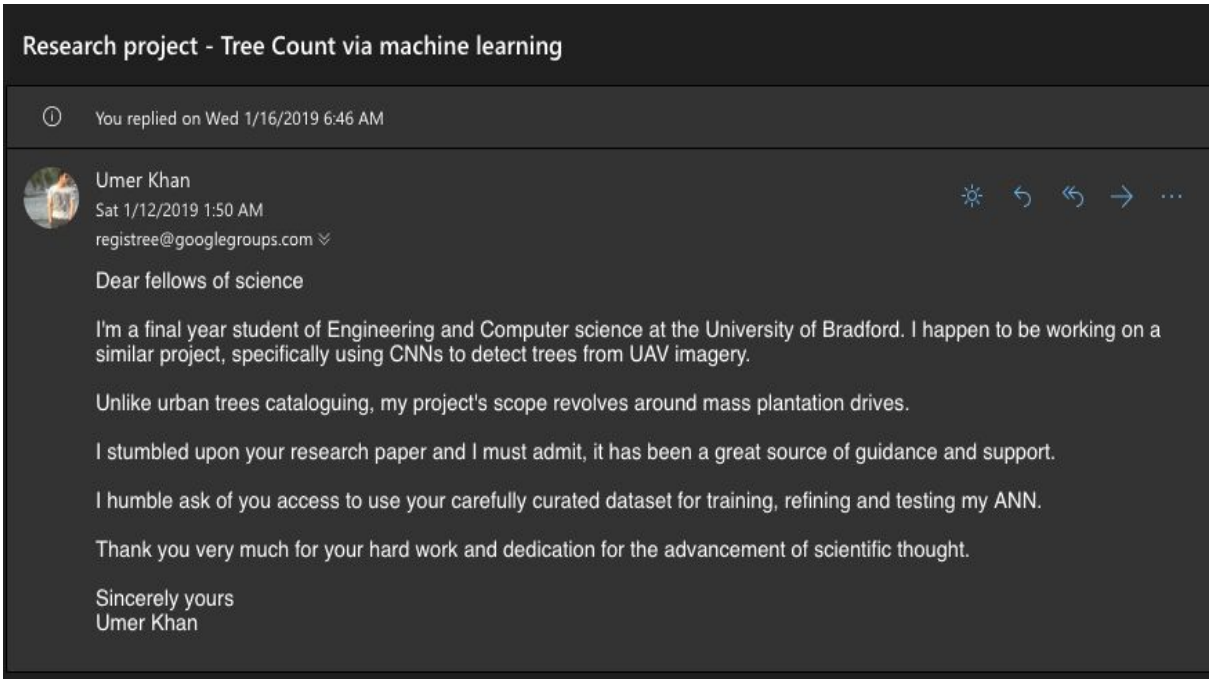
University of Cambridge
Advanced Level · (2012 - 2014)

University of Cambridge
Ordinary Level · (2010 - 2012)

4.2. Email writing

My ability to write clear, concise and effective emails improved marginally which enhanced my productivity many folds. I often thought meetings, many of them anyway, were futile, unproductive and awfully long. I was fortunate to have an easy going supervisor hence my written communication with him via email regarding my project proved a blessing in

disguise. I attach two instances; figure 11 shows my correspondences with researchers from Caltech and ETH Zurich for access to their dataset while I followed a schedule, while figure 12 shows my correspondence with Dr. Junaid regarding constraints and problems.



Research project - Tree Count via machine learning

You replied on Wed 1/16/2019 6:46 AM

Umer Khan
Sat 1/12/2019 1:50 AM
registree@googlegroups.com

Dear fellows of science

I'm a final year student of Engineering and Computer science at the University of Bradford. I happen to be working on a similar project, specifically using CNNs to detect trees from UAV imagery.

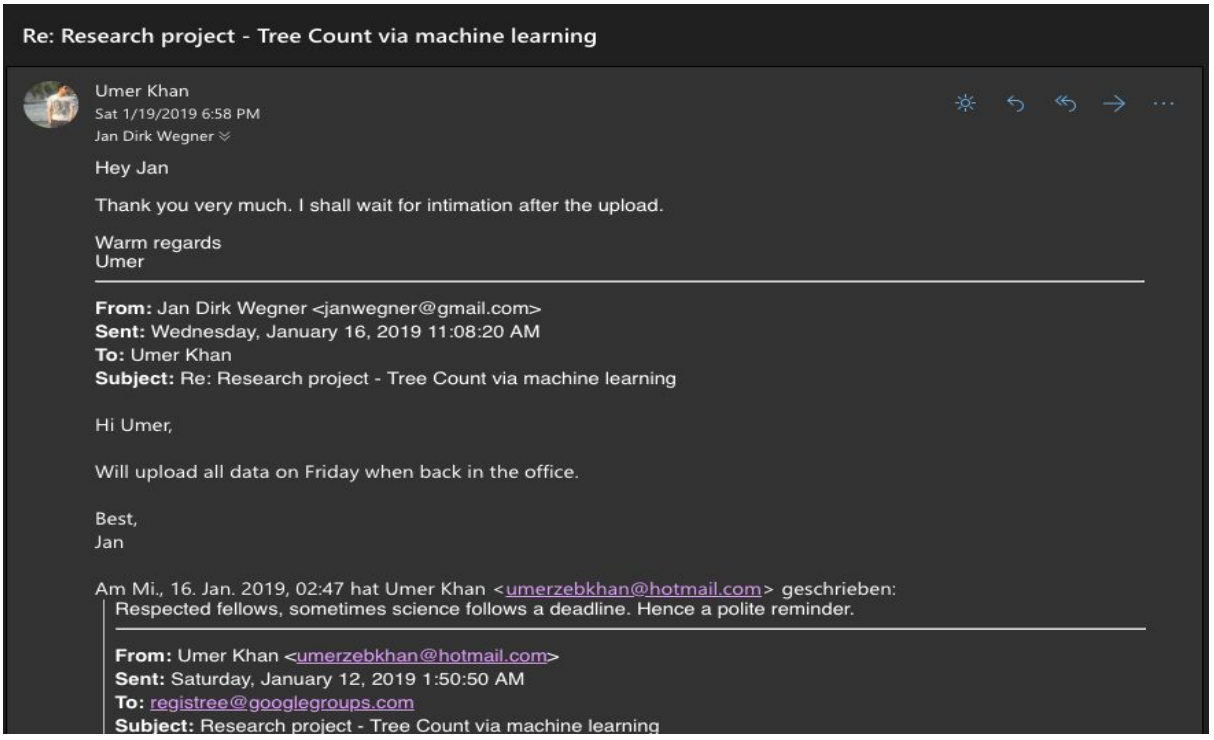
Unlike urban trees cataloguing, my project's scope revolves around mass plantation drives.

I stumbled upon your research paper and I must admit, it has been a great source of guidance and support.

I humble ask of you access to use your carefully curated dataset for training, refining and testing my ANN.

Thank you very much for your hard work and dedication for the advancement of scientific thought.

Sincerely yours
Umer Khan



Re: Research project - Tree Count via machine learning

Umer Khan
Sat 1/19/2019 6:58 PM
Jan Dirk Wegner

Hey Jan

Thank you very much. I shall wait for intimation after the upload.

Warm regards
Umer

From: Jan Dirk Wegner <janwegner@gmail.com>
Sent: Wednesday, January 16, 2019 11:08:20 AM
To: Umer Khan
Subject: Re: Research project - Tree Count via machine learning

Hi Umer,

Will upload all data on Friday when back in the office.

Best,
Jan

Am Mi., 16. Jan. 2019, 02:47 hat Umer Khan <umerzebkhan@hotmail.com> geschrieben:

> Respected fellows, sometimes science follows a deadline. Hence a polite reminder.
>
> ---
>
> **From:** Umer Khan <umerzebkhan@hotmail.com>
> **Sent:** Saturday, January 12, 2019 1:50:50 AM
> **To:** registree@googlegroups.com
> **Subject:** Research project - Tree Count via machine learning

Fwd: [CIFEX] Files available for download from Jan Dirk Wegner

Hello umerzebkhan@hotmail.com,

Jan Dirk Wegner <jan.wegner@geod.baug.ethz.ch> has stored files on our server for you to download. File information appears below.

From: Jan Dirk Wegner
Email: jan.wegner@geod.baug.ethz.ch
Comment: Hi,

here is all data for tree detection and species recognition.

Best,
Jan

The files are (follow link to download):

PasadenaUrbanTrees_SpeciesRecognition.zip https://cifex.ethz.ch/?fileId=201047&user=umerzebkhan%40hotmail.com
PasadenaUrbanTrees_Detection.zip https://cifex.ethz.ch/?fileId=201046&user=umerzebkhan%40hotmail.com

Expiration: The files will be removed on 2019-01-25 at 23:59:59

For downloading you have to enter the following password: b7vx]Pr:QDjWWzRiqSt]

Link to login to the system: https://cifex.ethz.ch/?user=umerzebkhan%40hotmail.com

Fig. 11. Email Correspondence Screenshot

Umer Zeb Khan <umer2014@namal.edu.pk>

Presentation + update so far

2 messages

Umer Zeb Khan <umer2014@namal.edu.pk> 9 May 2019 at 17:47
To: Junaid Akhtar <junaid.akhtar@namal.edu.pk>

Asalaam alaikum Sir

Please find attached below test image after stitching together every 10th frame extracted from a 29 seconds video. Given any more frames, the system runs out of memory. More samples images are placed in E drive on your desktop computer along with sample video used.

So far, the progress is, a cloud based solution for tree detection followed by a script for tree count on classified image. In conjunction, a model trained on local machine gives the detection and count on the given image.
Image stitching from a video captured by drone takes place with region of interest cropped in the output image.
A dataset of around 1200 images has been prepared, including augmented images such as axis flips, sunny, rainy etc filters all with annotations.

Any suggestions for presentation, if any, are welcome.

test.jpg
463K

Junaid Akhtar <junaid.akhtar@namal.edu.pk> 9 May 2019 at 22:38
To: Umer Zeb Khan <umer2014@namal.edu.pk>

Good job.

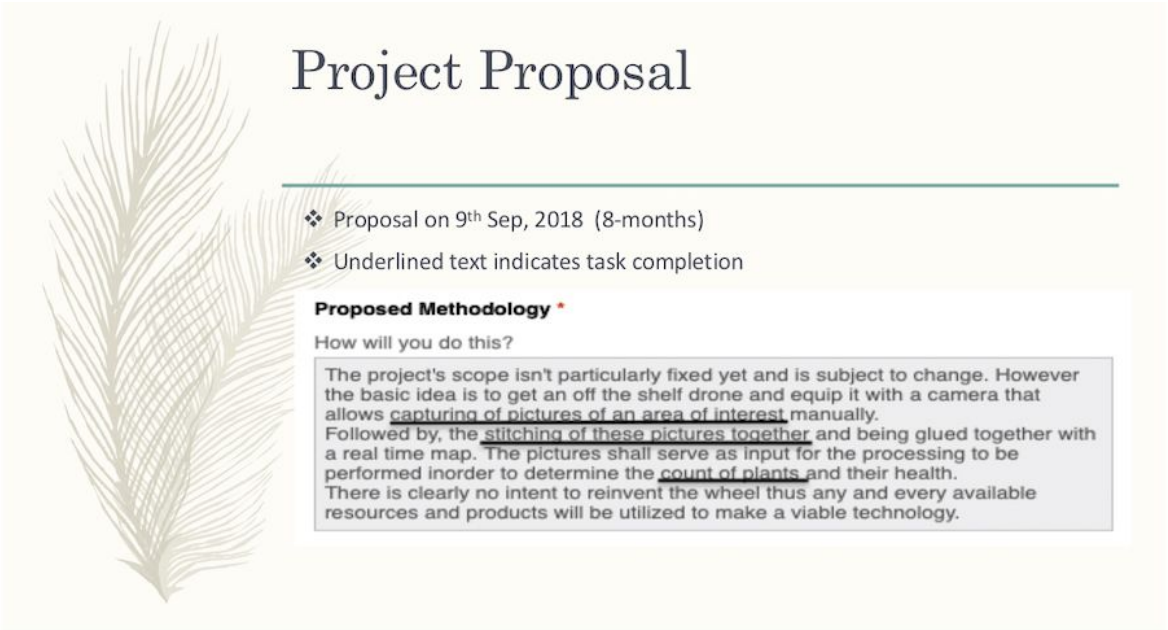
A man or his work should be far better than his presentation or cv !!

Best wishes and prayers,
Salam
[Quoted text hidden]

Fig. 12. Screenshot with Dr. Junaid

4.3. Final Presentation Slides

My mid project presentation was primarily composed of an oral presentation since I always believed slides distract the attention from the presenter. However my views have since changed as in the age of big data and beautiful visualizations, refusal to use slides are considered a practice of luddism. Given below are images of the slides used for final presentation, which improved the quality of my product defence and served a constant reminder of everything worthy of mention to enhance project comprehension within nine slides.



Unmanned Aerial Vehicle

- Ryze Tello Quadcopter Drone
- 5 MP camera
- 720p, 30 FPS video
- FOV - Oblique (87°)
- 13 minutes flight time

Initial Data Set

- 3 distinct types of images
- Total images : 126
- Manual annotation of trees in each image
- Varying dimensions

Oblique to ground (87°)

Parallel to ground (180°)

Perpendicular to ground (90°)

Enhanced dataset

- Total images : 1260
- Labels preserved of initial dataset
- Data augmented via two main ways

1. Axis of rotation	2. Filters	
❖ Horizontal Flip ❖ Vertical Flip ❖ Horizontal – vertical Flip	❖ Blur	❖ Shady
	❖ Motion Blur	❖ Snow
	❖ Rain	❖ Sunny
	❖ Salt & pepper	

Image Stitching

- Drone video at 30 FPS
- Frame extraction
- Stitching together frames to form panorama shot

Tree detection

Cloud Solution Sample

Cloud Solution

- Nanonets
- Image annotation
- Training
- Tree detection
- Tree count

Machine Solution

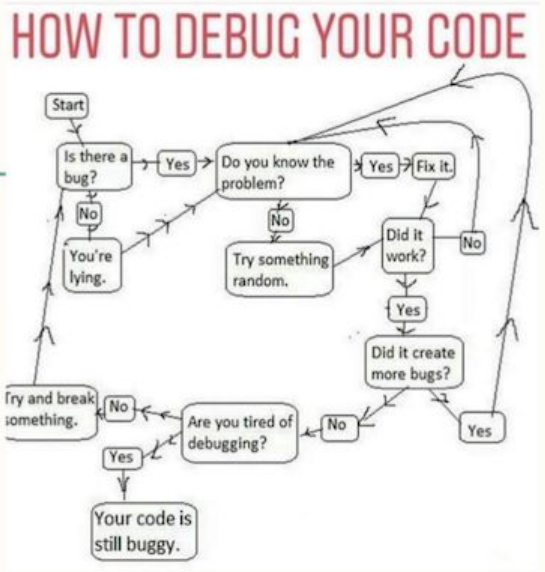
- Faster RCNN + Resnet 50
- Training
- Tree detection & count

Future Work

- Frontend Interactive App
- GPS mapping of detected trees
- Physical tagging of tree via robot
- Using hyperspectral sensors to determine plants health i.e. VI, NDVI

Thank You!

Taking Questions, if any?



5. Reflection

The entire duration of my undergraduate studies has been a remarkable journey of self exploration, grueling sculpturing and unprecedented growth in both public and private spheres of my life. As evident by the preceding chapters of this portfolio, I underwent and experienced the powerful transformation of a naive adolescent to an informed professional adult. My time at the beautiful valley of Namal has killed the idealist in me, to pave way for the realist. Where Bradford's motto of "Making Knowledge Work" has manifested in the shape of my successful completion of the final year project, Namal's motto of "Shaping those who shape the future" can be seen quite literally.

Taking the project's start was a tough phase since idealism dicates anything was possible however within the very real confines of reality, I opted for a project in union with my level of expertise and personal interest. Hereon, the process of wading into the deep begun and I researched extensively and tried implementing technologies relevant to my problem's solution. Gradually with the undiminished support of my friends, man's best friend google and the insightful mentorship of my supervisor transpired a complete solution to the proposed problem submitted at the start of October as project proposal. During the last two semesters spanning over eight months, I have attained a valuable outlook on life and society and our place as the only being with superior intellect in it. I know, sometimes, that too is left subject to debate by our own kind.

On 22nd April, the open house was conducted at college campus to pitch the student's project to potential employers. I was fortunate enough to be shortlisted for two interviews after an initial screening. The first one was by a representative of Coca Cola, the multinational company, as a marketing training officer. The interview went well or I thought, until I knew for certain when I received a call from the human resource department about my availability to join subject to a final interview. The other was by a national software house called, System Limited which took a written test followed by a short interview. Post open house day, a technical interview was conducted via skype to test my fundamentals of computer science along with my approach to problem solving. I was asked about my schedule and availability for a final interview at their office in Lahore.

The idea of being independent seems liberating but what's in store for us in the future is anybody's best guess. My ability to think critically, entertain different worldviews and dissect a piece of information scientifically shall remain at the forefront of defining my life as an individual and professional. Completion of this document is a tiny step in the right direction. If you are reading this, I am humbled and gratified for you to be a part of this journey, thank you.

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