**CRAIG:** Hi, I'm Craig Smith. And this is Eye on AI.

**CRAIG:** This week, I speak to Almammon Rasool Abdali, a machine-learning engineer and PhD student in Baghdad, Iraq. If I sound a bit robotic in this introduction, it's because I am down with Covid-19 and am using an AI synthesized version of my voice for the introduction.

**CRAIG:** I was in Baghdad recently doing research on the higher education system there, which has been devastated by years of war and political instability. While I was there, I wanted to find out what was happening in deep learning in Iraq and after some research I came upon Almammon, who is one of the more prominent members of a small but growing deep learning community. We talked about his work, which involves vision systems to detect violence, and about the state of artificial intelligence research and teaching in the country generally. We also talked about how companies like Google and Amazon are helping places like Iraq with their open-source, free research tools. I encourage anyone listening who wants to help this country recover, to reach out to Almammpn and see what you can do.

**CRAIG:** Before we begin. Let's take a moment to thank our sponsor, ClearML, an open source MLOps solution. You can give them a try at clear.ml. Tell them Eye on AI sent you.

Meanwhile, I hope you enjoy the conversation with Almammon as much as I did.

**CRAIG:** Okay. Almammon. I'm delighted to talk to you. I'm interested in hearing about AI and machine learning research in Iraq generally. So, I thought maybe you could start by telling us where you grew up and where you went to school, how you got involved in machine learning, and then talk about the current state of machine learning research in Iraq.

**CRAIG:** Do most universities have some researchers involved? Is it localized in a few universities? I'd be very interested to hear.

**ALMAMMON:** Okay, thank you. Firstly, I grew up in Baghdad and my first-time approaching computer was after Saddam regime in 2003 after this, because we did not have access to computer, personal computers. Some families have access to this, but this is because of the state of the economy of each family.

**ALMAMMON:** But it's getting me most interested when I start with the programming and coding in general and software. I was studying chemistry at that time. So, it was outside the computer science. But then I found myself itself proficient in software development and started as a software developer in some companies.

**ALMAMMON:** So, I decided to study computer science from the beginning. In the first class in the general AI talking about classical artificial intelligence and statistics-based search and genetic algorithm and stuff like this. I was asking the professor how this can be connected with data and other things. And he answers it is all about if-and statements. So, I was shocked that this is a classical role-based thing. So, the curiosity takes me to start searching for this and lucky for me that the world is so open, especially Stanford university, I've benefited a lot from its open modules, especially the computer vision one by professor, Fei-Fei Li, I watch it all. I start to study from this area and then it came to me the news from Google about the open source TensorFlow, which was the first thing enabling us to use GPU with ease of use and building these deep neural networks.

**ALMAMMON:** And it started from this.

**ALMAMMON:** I have two bachelor’s degree, one in chemistry and the other in computer science. Because I found there is a lot of things I need to learn. And I was studying the data structure from its basic, studying the operating system, and many things, even if it's not being studied in deep level, I take the syllabus, I take each book seriously and try to learn everything in between, even the chapters do not teach to us. I was reading it because this is what I'm motivated about.

**CRAIG:** And then that computer science bachelor is when the professors were teaching classical AI. That was your bachelor. Is that right?

**ALMAMMON:** Yes. Yeah, that was my bachelor.

**CRAIG:** And was that at university of technology?

**ALMAMMON:** No this was Al Rafidain university a private university because you are not allowed to rejoin the public universities if you already joined one. So, I submitted my application to Al Rafdian, and it was to me, good journey, but some classes were not connected to real world. Those classes that was software. I connected with a project that I have working with, but this curiosity about AI and machine learning, which is not studied in depth, led me to do my search around it.

**ALMAMMON:** So that is why I started to study the Stanford by Fei-Fei Li because it's what very connected to practical things and the deep learning course by Andrew Ng started after this about two years and other stuff. This is a continuous journey of learning.

**CRAIG:** Yeah. That's fascinating. When did you then go to university of technology? where you we're now

**ALMAMMON:** In 2017 about, the starting of my master study and my passion to do the master’s degree is the main project that I chose

**ALMAMMON:** There is a problem in our public safety in Baghdad and especially Al Karrada and a company, Huawei has offered safe city, a smart civilian system for Karrada district. It was very costly. And I was thinking maybe I can do something around it.

**ALMAMMON:** Maybe I can try to tackle some of these problems. And to build some kind of smart surveillance systems. So, my motivation to study the master is because you will be going to do some structure of the project and you have to give time on it. So, it will be best to do it in this way. So go to university of technology

**ALMAMMON:** and it was some hard journey to take professor and let convince him that I want to do this project. You have to listen to me. I want to explain it. It was very hard journey because everyone I just say, okay, you don't have to worry about the project. Now you have to worry about your degree and to get to the next semester, I'm saying, Hey, I can.

**ALMAMMON:** Go to the next semester. Me, I'm clever. Everything is okay, but I want to do my idea. The approach that we are doing research here is not the student give the topic. The officer chooses specific topics, and that the student will try to compete, or anyone can choose from these.

**ALMAMMON:** And I don't want to waste my time on a classical approach or anything else with respect to every idea. But I was lucky, I got my supervisor, Dr. Rana, which was very open.

**ALMAMMON:** And she never knew me, but she listened and try iteratively to enhance the idea. And we came up with a good idea. And it was a good journey and get a good result from our work. This is the story of the research itself in the university of technology.

**CRAIG:** So is the focus at the university of technology still on classical AI.

**ALMAMMON:** Each supervisor has its own vision. So, we have some. Professor focusing on solving AI by evolutionary algorithms, and they have invented many novel ideas around this. They are focusing on doing deep learning and, but it is not just the problem of the professor itself. This is some kind of multidimensional problem. The first thing is that there are no enablers. So, there is no good labs. There are no clusters or workstation that you can work with to make advanced research around the AI around deep learning itself.

**ALMAMMON:** Also, all the university underestimating the work around building data. when we are working industrial, the first thing that we mostly touch is to work on building data and cleaning this data. Stanford and many research labs, they came with the data either for benchmarking or for solving new things and iteratively working on research around it.

**ALMAMMON:** Any project to PhD or master that you work in with the data, you will not get a good degree. So, the number one thing that stop a student we cannot work on data. They will underestimate it. We are not going to get degree. So, what the benefit is.

**ALMAMMON:** So that is about the data, and I told you about the enablers and the infrastructure, the second thing is the general vision of the government itself. So, some European countries, universities are focusing on AI for health and medical, because this is the economic way of the country itself.

**ALMAMMON:** We are a country based on the oil economy. But these things have to be reflected on the vision of that research worker from the universities. So, accelerating this area is, as I told you a multi-dimensional problem, it's not just about supervisors themselves. I see many students, they have a good idea, even a new idea in deep learning, they are almost in the basic or the elementary stages. Maybe you see a master of PhD degree that's working on just doing object detection stuff.

**ALMAMMON:** And this is why I started to try to solve this to at least give better high-quality resources, workshops, and making a global awareness for the community itself.

**ALMAMMON:** for example, my last paper, it was about trying to overcome the lack of hardware resources.

**ALMAMMON:** And if you have a station where you don't have a good amount of data, because this is task that you have to solve it in the end.

**ALMAMMON:** I work in a cloud, and everything is okay.

**ALMAMMON:** But getting back to the researchers. There is no budget that's supporting you to do it on the cloud. And also, that you can use your own money, or most students using Google CoLab and now came AWS SageMaker studio lab, and also Kaggle GPU. it's not enough.

**ALMAMMON:** It's not enough if you're going to touch any large data, you will find yourself wasting a lot of time, a lot of hours or days to just do small amount of training and not getting good results. So, this kind of bottleneck making most researchers go other directions. But me in work, there is a company budget and AWS giving you the hardware resources, and they also have a support for researchers, not just AWS, Google, also that they can submit and get a credit in the cloud to use it.

**CRAIG:** I see. So, when you mentioned the company, you're still working as a software developer, has that continued throughout your studies?

**ALMAMMON:** I shifted in 2015 and in machine learning engineer role, I started to work and now I have remote work with a company as AI team lead. A start-up in USA and also machine learning, leading in the company that I work here for in Iraq, but I still working because most of the work is Remote and little time in office, but when I studied the master itself, I was continuing to work.

**CRAIG:** The Iraqi company, what kind of company? What domain is it in? And also, the U S company, the startup. Are they computer vision companies or what?

**ALMAMMON:** with Iraqi one, the Iraqi creative solutions. It's a company started as a mobile and web development custom software company.

**ALMAMMON:** And then I introduced some new service to our client, things like recommendation system. We have some tier news agencies and newspapers in Iraq as our client for their website and mobile applications. And we provided them the recommendation system and smart analytics, so they can know more beyond what the normal analytics doing, the data reporting analysis also to them

**ALMAMMON:** and the other part is computer vision. The same theme of the smart surveillance system. We have a side contract with the Indian company. We sold the software to them.

**ALMAMMON:** the other startup is about social media for public good. And for providing help to people. It's a specialized one. It is in its early stages, in the social media company, you will have many tasks. You will work with an NLP with vision.

**ALMAMMON:** And mostly we work on graph data.

**CRAIG:** You mentioned Huawei and the smart cities initiative. Did they provide funding for any of your research I'm curious? What support you got from

**CRAIG:** them?

**ALMAMMON:** No, I didn't got support. Just thinking about them as some kind of ideal scenario to work with. The most interesting to me was the activity recognition system. I found that violence activity recognition has some weak point. There is little around this service. So started this as the main service in my master’s degree. And the published paper that I got was the state of the art in the result and the speed.

**ALMAMMON:** But then when the transformer network has gained all the attention, I was having three ideas. Two of them was similar to things published by both Google and Facebook, then I start to afraid I have to publish the third idea as quick as possible.

**ALMAMMON:** This is why I chose to publish this one, the data efficient video transformer in nearest IEEE conference. The conference itself is a good way that you can push your work fast. When you send to journals, you have to wait a lot.

**ALMAMMON:** IEEE has some regional chapters, they have event but if you publish in a local conference or a local journal, you get a lower degree than when you publish in a global one. this is why my first choice is the global one

**ALMAMMON:** Most of conferences happen virtually, but when I was in my master’s degree, I traveled to Malaysia to present my papers there. Also participating in conferences give you a lot of networking, good research network that will help you in the future.

**CRAIG:** Let's talk about the paper it's interesting to me, given the turmoil that Iraq has gone through that, that you chose to focus on violence detection.

**CRAIG:** Is that of field of study in Iraq?

**ALMAMMON:** My focus in this area because it's a practical issue here. We lose life in these things. And the thing that's happened in Karrada was so horrific. I try to take off of pressure that I put in myself, but I know that is no adaptation for any ideas that we will do.

**ALMAMMON:** It's hard to implemented in low infrastructure. but at least you can say that we do our best.

**CRAIG:** Just for listeners. Can you explain the Karrada incident?

**ALMAMMON:** Yeah. So Karrada is a place. Maybe if you see it. So, a lot of people there are Karrada has been attacked. Many times. One is with a large explosion and fire, which is the one that I talk about, and many families have lost their lives.

**ALMAMMON:** Whole full family. Just ashes and it's something that, yeah.

**CRAIG:** And so, your work was on using transformer algorithms for violence detection, and because of the lack of available data, you created a data efficient video transformer for violence detection.

**CRAIG:** Can you talk about that?

**ALMAMMON:** Yeah. Firstly, this network is for general action recognition, not just for violence. But the main thing is that the state-of-the-art video transformer published by Facebook called TimeSformer. It's the very good efficient transformer, but it needs a lot of data to converge and to get a good result.

**ALMAMMON:** And it's also it's large model. So, if you have a single GPU and you want to fit it on some kind of data, you have to choose very small batch size and, you don't have this flexible thing. So, the design of transformer itself started in NLP, but then adopted in vision it to start by embedding the main feature and then you calculate its position and then you give it to transformer itself. So, my idea was we know that convolutional neural network is very good at extracting the spatial feature. And especially if you use transfer learning here. So, I treated convolutional network as a way to embed the feature.

**ALMAMMON:** So maybe you do some hand-based feature engineering for the frame itself, but convolutional network could do it automatically for you. So, what I do is that distributing the frames for each frame will go to the similar convolution network. I choose a very basic one, but it's also very light and I just extracted about 512 features. This is the dimension of the feature then I calculated them position using sine cosine positional encoding and fit it to transformer.

**ALMAMMON:** And the model converged very fast and because it uses the pre-made features, it's very helpful and make it converge very fast in the first iteration with the very complex data set, the data set that I tested with the highest accuracy, which was using convolutional, LSTM, and also using convolutional 3D, which is a very good at video, but it has two weak points.

**ALMAMMON:** The first one is the need also for hardware resources. And the second one, it cannot catch a long dependency maybe here in action recognition, we don't need very long dependency, but we are talking about general theme of building a neural network. And it's happened that this design and this architect is the first combination of both, because most of work they're using a full transformer from the beginning to the end, I try to benchmark the data set with TimeSformer.

**ALMAMMON:** The new network that I come with surpass in its results. And also, the speed it's get it's very good. And also, the use of GPU memory, which will allow researchers to have freedom choosing the number of frames to encode or choosing a bigger batch size and things around this.

**ALMAMMON:** This is the main idea of the work itself. I have implemented in violence as mentioned it's that direction because when you work with some kind of data and you're already building the pipeline for the pre-processing campaign like this. You easily can accelerate your research and try just to work around modeling and enhance it.

**ALMAMMON:** So, this is the two reasons to enhance the work this way. And also, the previous paper that I did was that the convolutional followed by LSTM is a very good, efficient way but I now found the transformer has beaten LSTM in this part and benefited from the transfer learning.

**CRAIG:** And then talk about your results because you did have very good results

**ALMAMMON:** yeah. So, the result is about 96.25. Accuracy for this real-life violence situation dataset, and the previous highest result was about 91.

**ALMAMMON:** So, it's a very large gap between these and the training TimeSformer was 72 or 71, which is also a very big gap. It's not because time former is not good, but times former need a large data to converge. It's been trained in self supervise method and being trained in Facebook with a very large dataset, but if you don't have access of the data that Facebook have, and you don't have this larger clusters.

**ALMAMMON:** The current theme of researchers is large models, either with vision or with language, but here they are trying to benefit the transformer in the other way with a smaller sitting.

**CRAIG:** you trained and tested it on the real-life violence data set

**CRAIG:** Is that Facebook data set?

**ALMAMMON:** No, it's a benchmark in dataset for published in IEEE in a conference of smart cities and this data set is why I choose it because the highest result it's 91, which means that there is a need for improvement here.

**CRAIG:** Data sets oftentimes are biased depending on where they were created. Is that relevant to Iraq?

**ALMAMMON:** When I examine it. Yes, because it's contained mostly situations in Egypt and similar kind of activity that's relevant.

**ALMAMMON:** But also, when it's a benchmarking dataset from the researcher perspective it's a way that you can compare the main work too so the first one that I was thinking about when I am taking the data sets in the previous work, in the master thesis, what I tried to take it relevant to Iraq.

**ALMAMMON:** But here, when I did the research itself, I was thinking about the hardness of the dataset. That, to be honest because the most challenging the data set in the situation that has happened, maybe in Arabic, that we have some kind of contact with people, but it's not a violence that you may be shaking hands or hugging someone it's maybe not normal in other cultures.

**ALMAMMON:** Some kind of joking, but it's not violence. This dataset contains something like this. And also, it's not just to containing a CCTV normal setting of camera. It's also containing a foreign. Video like a horizontal or vertical one, moving things. So, a lot of environments sitting that make a challenge.

**ALMAMMON:** The more challenging the data is you can benchmark your model on, but when the data is easy and the environment is the same, maybe some kind of biases will go to these scenes.

**ALMAMMON:** So, this is why I propose. in the previous work, that the combination between these datasets, the crowed fight and Hollywood movie, these data set they are very easy and this one is a challenging one to choose. And of course, if you want to build for a specific country, you have to take into consideration the type of camera that you will use and train your model based on the custom data you have.

**CRAIG:** And given your results. Are you continuing your research in this area or are you moving on to other things?

**ALMAMMON:** I am trying to improve the data to improve the results and I getting good results. I'm going to publish this, and I will stop.

**ALMAMMON:** I want work that more challenge. Right now, this kind of work it's not that hard.

**CRAIG:** In terms of implementation of this kind of work, has there been any interest by anyone in Iraq to take this research and deploy it in some system?

**ALMAMMON:** Actually, unfortunately, no, I can't give them any reason because firstly, I won a hackathon by Facebook by this violence system

**ALMAMMON:** which is a hackathon based on a project and it was a regional prize. And also, I was on TEDx Talk talking about this system and in media for many channels talking about these kinds of things. But the only interest I get is from outside countries, we sell some project to an Indian company about this work, and we are shipping some kind of software for them in this, but here in Iraq, nothing is happening in this direction.

**CRAIG:** And how would you imagine it being implemented?

**CRAIG:** Would this be to scan. Social media or would it be to scan CCTV feeds?

**ALMAMMON:** So, the proposal I give in the master was to handle the CCTV and it was not just about the violence itself. It's about building smart video search engine then you will have a very fast and efficient retrieval system before the event that's happened with the alert and then latest adopting the microservice architecture for handling the work and many event that's happened. I give a lot of scenarios. The work was not just about the violence. It was containing violence service. It is containing a fire detection and also containing facial and ANPR [Automatic number-plate recognition] systems. So, it was some kind of smart CCTV system or smart surveillance system so you can search for a specific event or summarize the event that's happened and maybe you will receive an alert for a fire that's happening at a specific place with its location by the camera itself. So, the implementation was about the camera itself, not about social media, but still none of them has been implemented.

**CRAIG:** In this work you were able to use, did you say Google cloud credits or Amazon cloud credits

**ALMAMMON:** for the training? Yeah. I use normal Google CoLab, it was CoLab pro, which is monthly subscription because the, even the data self is a small, it's a 2000. Videos 1000 for each category and to get the good result in small dataset and this one can work with a small data and benefit.

**CRAIG:** Deep learning in Iraq, is it growing among students and researchers and how widespread is it?

**ALMAMMON:** In Iraq as for the students, it catches eyes. I have a group about 4,000 student researchers and many of them, they are working on this field, even though maybe you call it a basic or fundamentals work, but they are approaching it.

**ALMAMMON:** I did many workshops with the many colleagues and professionals in many areas like reinforcement learning and doing workshops in MLRs and also in advanced vision transformers and language models and cooperation with deep learning.ai, connecting with these organization and connecting with global speakers in this kind of workshop, make Some kind of momentum, so the student that's working here seeing yeah, there is a place two or three shifted from general deep learning. Many of them now working on privacy and most of them, they now have good result in the research.

**ALMAMMON:** Other, they are starting to work on reinforcement learning. Even if that is not good at the universities that they are in, but it's helping them find a place to share and connect with good quality speakers and resources. That's help pushing these things.

**CRAIG:** What are the biggest constraints for those students? Is it computing resources? Is it having professors that understand deep learning? So, what are the obstacles?

**ALMAMMON:** For student the main thing that I found is the jump from studying classical things that will not be implemented to a specific kind of research they have not heard about. And they have a time constraint. They maybe have a couple of months of direction, maybe some professor direct to the student to the wrong path, and they spent months,

**ALMAMMON:** and then they send messages to me that I have three months and I have to do this research is okay. So, you don't have the fundamentals. You have to focus on getting the elementary things, you don't know how to TensorFlow or PyTorch yet. And also, you don't know the fundamental of convolutional neural network.

**ALMAMMON:** I see it in a large number of students, they reach out to help. The main constraint is the learning resources, and the students believe that when they go to university, they will study artificial intelligence. But when you look at the syllabus and when you look at the materials it's about very classical things.

**ALMAMMON:** If you look at the researchers for many universities in Iraq, they are doing AI from very old years. Time has stopped in this area.

**ALMAMMON:** So, this is the problem for most of the group that I work with, I'm talking about thousands of students from different universities.

**ALMAMMON:** One of the students, she reached to me about zero shots machine learning, and she want to do it with deep learning. I said, yes, it's good topic. But the fundamental she had; it was so hard for her to digest information. They have a little knowledge. They don't know the whole picture because they have not studied from the beginning.

**ALMAMMON:** So, when you want them to apply this research, or you want them to apply to jobs they have some weak points.

**CRAIG:** And how do you think Iraqi universities could solve that?

**ALMAMMON:** The main thing is that we need a revisioning of our study materials. You have to add new materials.

**ALMAMMON:** It's not so new anymore. So, you have to convolutional neural network. It is very fundamental, but you're not studied in the university. And the other thing is that there has to be specialized labs in AI and machine learning.

**ALMAMMON:** There has to be some kind of specialized research lab collaborating with global things or taking side project from companies that work in an oil and they are global companies. They have the data. They have sensors around the oil pipelines, and this can accelerate the data science in this area. Also, that the work in telecom and ISP, maybe they are not using advanced AI yet, but you can make a partnership with them to try to get some benefit from the data. These things have to be organized between the ministry and the companies that's working here because in the end, the companies can collaborate. It's research. And maybe they will do heavy lifting on the research with a small budget, but they will get a result.