

The Winning Teams of the AI Robotics Vision and Automation Technology Challenges Competition 2021 organised by HKU SAAS Data Science Lab



Figure 1 The winning team of the university category, with Dr Eddy Lam, Director of the HKU SAAS Data Science Lab (second from the right) and Dr Adela Lau, Deputy Director of the HKU SAAS Data Science Lab (fourth from the right).



Figure 2 The winning team of the secondary school category, with Professor Guosheng Yin, Head of HKU Department of Statistics and Actuarial Science (leftmost), Dr Eddy Lam, Director of HKU SAAS Data Science Lab (rightmost), Dr Adela Lau, Deputy Director of HKU SAAS Data Science Lab (second from the right), and Mr Tung-Shek Wong, STEM teacher of Heung To Secondary School – Tseung Kwan O (third from the right).

Congratulations! 🎉 Louie Ho Shun Louisa, Wong Lo Yi Tiffany, Wong Chun Ting Issac, Tin Hin Wing Max, and Tsang Chung Ho Danny from Heung To Secondary School – Tseung Kwan O!



Figure 3 Award ceremony at HKU

“Studying should not aim at the grades (求學不是求分數). Ability to put theories and knowledge into practise is more important (學以致用才是最重要).” said Professor Guosheng Yin, Head of HKU Department of Statistics and Actuarial Science.

The Data Science Lab (DSL) of the Department of Statistics and Actuarial Science (SAAS) at the University of Hong Kong (HKU) has successfully organised the “AI Robotics Vision and Automation Technology Challenges Competition 2021” in collaboration with various companies and corporate sponsors, including Marvel Digital AI Limited, PricewaterhouseCoopers (PwC Mainland China and Hong Kong), Power Hub Ltd, Vision Real Capital Limited, Kinth Technology Ltd, etc. Being held for the first time, the Competition provides students with real industrial problems to which they have to develop innovative AI (Artificial Intelligence) and IoT (The Internet of Things) solutions by integrating science, AI technology, engineering, statistics and mathematics. There were two categories of contestants, one for students of HKU Master of Data Science and Master of Statistics programmes, another one for students of local secondary schools in STEM education.

With the mentoring from the academic staff in the Data Science Lab, industrial partners, and education leaders of the Association of I.T. Leaders in Education, there were a total of 30 groups of contestants participated in the Competition with very high quality proposals and outcomes. The upper photo (Figure 1) shows the winning team of the university category and the lower photo (Figure 2) shows the winning team of the secondary school category (Heung To Secondary School – Tseung Kwan O). After the Competition, Dr Danny Ha of the Academy of Professional Certification will offer a mentorship workshop to the winning teams on how to set up a start-up and look for potential funds. The DSL will continue to mentor these students on their innovative entrepreneurship journey.

“Our Data Science Lab promotes education through applied research and company consultancy. We teach our students through (i) accelerated learnings (e.g. competition, capstone projects, internship, and consultancy), (ii) company and multi-disciplinary collaborations and innovations (STEMIP - Science, Technology, Engineering, Mathematics, Innovation, Practical), and (iii) applying theories to real practices to create values and impacts to our society,” said Dr Eddy Lam, Director of HKU SAAS Data Science Lab.

For more details about the winning proposals and the Competition, please visit: <https://saasweb.hku.hk/datasci/competitions.php>



Figure 4 Our vision is based on the HKU’s (3+1)Is: Internationalisation, Innovation and Interdisciplinarity, which converge to create collective Impact.

“The HKU’s (3+1)Is strategy integrates Internationalisation, Innovation and Interdisciplinarity to create collective Impact. Our Data Science Lab adds a novel STEMIP education model (see Figure 4) to the HKU (3+1)Is strategy to put the conceptual ideas into practice.” said Dr Adela Lau, Deputy Director of HKU SAAS Data Science Lab.

AI in Behavioural Intelligence (Winning Project of University Group in the AI Robotics Vision and Automation Technology Challenges Competition) Artificial Intelligence Video Interview Analyser



By Mr. Jason Jin An CHAN, Mr. Tsz Hin CHAN, Miss Si Man TONG, Mr. Tsin Wai YAU, Dr Adela Lau (Mentor)
(<https://youtu.be/Rpmk8R4uKtE>)

In order to achieve better performance at job interviews, candidates desire and incline to have some mock interview practices. However, the relevant resources are very limited for this new norm. Therefore, our team from the Master of Statistics programme of the HKU SAAS Department developed an Artificial Intelligence Video Interview Analyser with three modules of video interview assessment, writing assessment, and performance review to analyse the facial expression of the candidates during interview, to assess the candidate's job knowledge with written assessment, and to calculate and visualise the candidate's overall performance respectively.

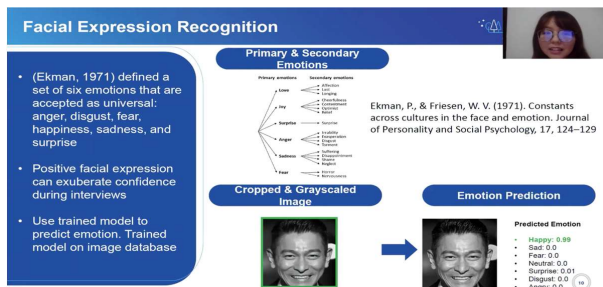


Figure 2 Facial expression classification with Haar Cascade and CNN.

Other than facial expression, since eye gaze is an essential part of body language that can determine important nonverbal behaviours, it can be used to understand a person's intentions. The team used the python GazeTracking library to measure where the eyes of the candidate are looking at. Candidates with gaze at the centre and direct eye contact are associated with high self-confidence and considered more passionate on getting the job.

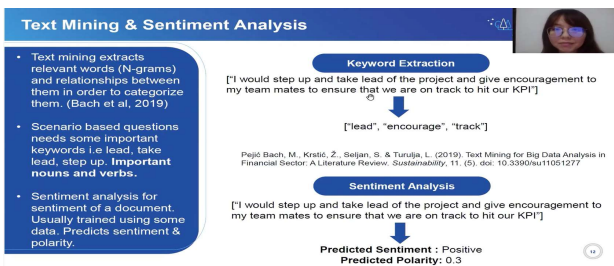


Figure 4 Facial expression classification with Haar Cascade and CNN .

"The facial expression system can be used in the surveillance, security, and communication field. We welcome business partners to work with the Data Science Lab and our students for a startup collaboration" said Dr Adela Lau, the Deputy Director of HKU SAAS Data Science Lab.

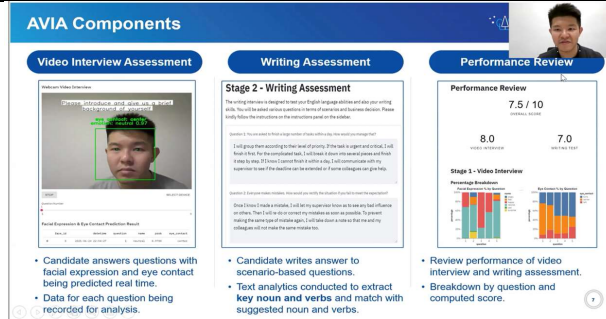


Figure 1. A module overview of the Artificial Intelligence Video Interview Analyser.

We used Haar Cascade with tuned parameters to detect the bounding box of the face, and apply the CNN model (with 4 Blocks of 2D Conv and Batch Normalization) to train the facial expression dataset (FER2013 dataset from Kaggle) with six emotions: anger, disgust, fear, happiness, sadness, and surprise. We used the trained model to predict the self-confidence level of the candidate. Positive facial expression reflects a higher confidence level during interview. All the results will be stored in a data frame for further analysis and score computation.

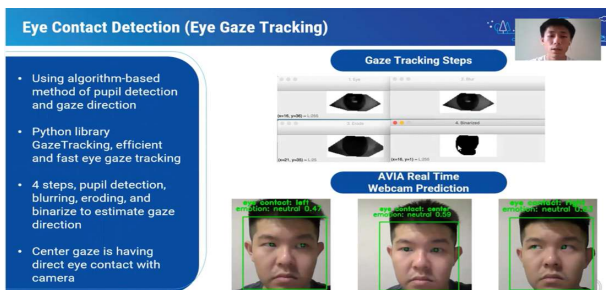


Figure 3. Eye gaze detection with python GazeTracking library.

Finally, we used TextBlob models for extracting the keywords and sentiment analysis, and compare them with the model answer to calculate the written performance score of the candidate. The results of the video interview and written assessments will be summarised in the dashboard.

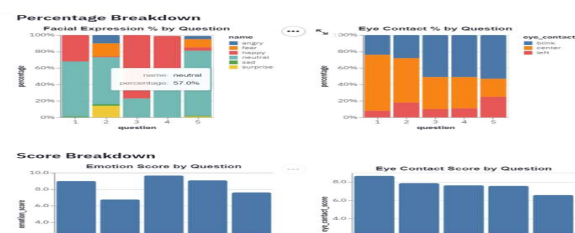


Figure 5. A dashboard to show the interview results of the candidate.

AI in Smart City (STEMIP Junior Nurture Program and Winner of Secondary School Group in the AI Robotics Vision and Automation Technology Challenges Competition)

Driver Drowsiness Detection System



By Tung Shek WONG (Mentor), Ho Shun Louisa LOUIE, Lo Yi Tiffany WONG, Chun Ting Issac WONG, Hin Wing Max TIN, Chung Ho Danny TSANG
<https://www.youtube.com/watch?v=5zoE5GPGjDU>



Figure 1 Driver Drowsiness Detection System- the winning team in the secondary school group

To detect drivers' drowsiness, drivers' eyes are detected first by Bayesian probability and then the Eye-Aspect-Ratio (EAR) is calculated based on the length and width of the drivers' eyes by simple arithmetic operation. Transport companies can analyse the drivers' drowsiness records using simple statistical methods such as calculation of mean, average of drowsiness and presentation of drivers' drowsiness frequencies. The analysis result can be presented using bar chart. Transport companies can analyse the statistics and schedule the rest time of the drivers to ensure that no driver works in a fatigue status. The experimental results showed that the system is able to detect the driver's drowsiness with 95% accuracy, even if the driver wears a mask or glasses.

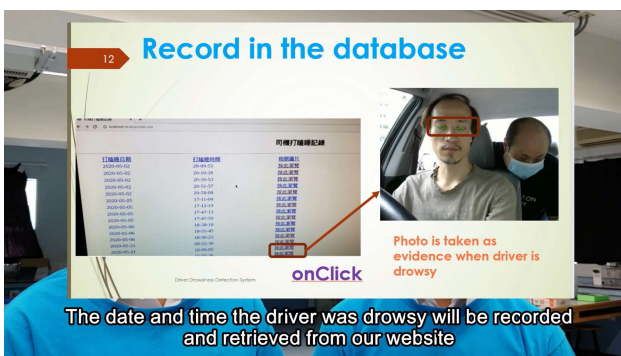


Figure 3 Driver Drowsiness Detection System - the winning team in the secondary school group.

"It is an amazing piece of work! The application can be used in driving safety monitoring, and some other applications like pilot safety control, security guard monitoring, classroom supervision, patient risks monitoring, etc," said Dr Adela Lau, Deputy Director of HKU SAAS Data Science Lab.

Through collaboration with HKU SAAS Data Science Lab in the STEMIP Junior Nurture Program (the competition), the student group from Heung To Secondary School (Tseung Kwan O) invented the Driver Drowsiness Detection System (DDDS) and converted the STEM education into innovation and practice (STEMIP). The DDDS involves STEM knowledge and skills such as Mathematics (probability), Engineering (Microcontroller and electronic appliances), and Technology (Python programming skills). The system integrates a new feature of voice and email system to give immediate alerts to the driver and the transportation company for risk assistance. It can greatly reduce the accident rate caused by driver's drowsiness.



Figure 2 Driver Drowsiness Detection System - the winning team in the secondary school group

The Bayesian probability, which is one of the basic AI models that the secondary school students have already learnt but they may not know, is a simple machine learning tool of the AI family. The detection is based on the calculated posterior probability according to the Bayes' theorem given by

$$P(D_i|x_i) = \frac{P(D_i) * P(x_i|D_i)}{P(x_i)}$$

where $P(D_i)$ is the probability of drowsy state, $P(x_i)$ is the probability of occurrence of characteristic x , $P(x_i|D_i)$ is the probability of occurrence of characteristic x_i during the drowsy state, $P(D_i|x_i)$ is the probability of drowsy state when characteristic x_i occurs. Through this competition, students can reflect their learning and apply the STEM into innovation and practice.

"You and I can do it! (你和我都能做得到!)," said Mr Tung Shek WONG (the project mentor & teacher) and Mr Fei TANG (the Principal). 🧠🌀