Identification of A.I. Generated Deep Fake Video by Higher Education Students

Kristiyan Delchev, Fadi Safieddine, Rawad Hamad,
School of Architecture, Computing and Engineering.
University of East London, London, UK
u1927769, f.safieddine✉, R.Hammad@uel.ac.uk

***Abstract*— The research regarding Deepfakes has been developing at a faster pace as technology to simplify the process becomes more accessible with the use of Artificial Intelligence (A.I.). Deepfakes are a part of the Fake News area of interest and, as such, have just as much impact on the current era of the Internet as the other parts that make up Fake News. This paper presents a survey of UK University Computer Science students (n=179) and tests their ability to identify a deepfake video using their mobile phone devices. The results of the survey are able to demonstrate, with statistical significance, that educated university students in the field of Computer Science failed to identify Deepfake videos even when altered to the possibility that one of three videos is Deepfaked. In fact, while being altered, the respondents gave equal red flags to all the videos and those who indicated the correct sequence were statistically less accurate than if the guesses were made randomly. This contributes to an increasing call that educating the masses may not be enough in the fight against Fake News.**

Keywords—DeepFake, A.I, Social Media, Fake News Videos, Generative AI.

I. Introduction

At the turn of the 21st century, the impact of fake news or fabricated content is proving a challenge for society. People unknowingly read or watch fake content. They often contribute to the issue by spreading fake content on social media. That is why it is very important to research the impact of fake news and fake media content in general and ways it could be controlled or stopped. As we take our first steps in Artificial Intelligence (AI), evidence suggests that the creation of fake news is becoming easier and faster, thus fanning the flames and escalating the issue. This research attempts to study how fake news videos integrated with A.I. could be utilised with Augmented Reality to dupe undergraduate students into second-guessing if a given deep fake section of a pre-recorded lecture is delivered by their lecturer or not. The paper considers opportunities and challenges. Additionally, this paper suggested that educating the masses may be useful, but more is needed in fighting deepfake.

II. Literature Review

To understand the underlying issues related to Deep Fake development, the literature review will first examine the concept of Fake News and its psychological impact, from which it will examine the ways to combat the current trend. Then the literature review presents the rising trend of 'Deep Fake' before reviewing gaps in the current literature.

A. Fake News

Fake News is not a new or recent phenomenon [1]. The news was traditionally seen as a product of journalism, which is expected to deliver 'independent, reliable, accurate, and comprehensive information' [2]. Because of that, journalists are expected to be independent, self-governed and impartial for this kind of service to function. It should be made clear that unintentional errors in reporting news do not make them fake [3]. In fact, the consensus among researchers is that the label Fake News has to be directly associated with fabrication, forgery, imitation, deceitfulness, misleading, etc. For that reason, one could consider fake news in a context where the intent is to misinform or mislead [3]. The definition, which has all the key elements in a concise sentence, comes from reference [4], which states that fake news 'should be reserved for cases of deliberate presentation of false or misleading claims as news, where these are misleading by design.

B. Psychological aspect of Fake News

'The illusory truth effect is the propensity to believe the validity and accuracy of information based on the repetition and continual exposure to information' [5]. In other words, the more something is repeated, regardless of its' validity and accuracy, it will be reinforced within the memory and become a truth for a person.

This builds into what is known as Collective memory and how a group of individuals remember an event or news to be true [6], [7] & [8]. This can occur at any level, from national to local or individual. This means that fake news/videos could be shared memories about a historical event, a lecture, a lesson, or a memory of a family holiday.

Thus, it is not uncommon for individuals to create narratives that are not reflective of something that actually happened but are reflective of their strong personal beliefs. This personal truth could be based on patterns recognised as truth, which states that a mind will convince itself that a story or a set of facts is true.

This is essentially a cognitive bias, which states that if you have a set of ideas which are not consistent with one another, the human processing will make them more consistent via a constructed narrative, which may or may not represent the reality of others [9] & [10].

C. The impacts of and attempts to combat Fake News

Fake news has a real impact on our lives, and one of the most prominent examples is from the 2016 election for the president of the United States. While much of the Fake News is reported in the Political and Medical spheres, other areas, such as religion, arts, music, and paranormal news, have not been spared [1]. The work by [11] shows a real tangible connection to fake news and how it impacted the voters during the election through the use of social media. Surveys in 2016 showed that 62 per cent of U.S. adults get their news from social media [12], [13] & [14] and that one of those platforms – Facebook, has been a breeding ground for fake news. That percentage is likely to have raised since. Another thing to consider is that a large part of the people who see fake news believe that they are factual [11].

The motivation behind generating fake news tends to be financial incentives through clickbait and advertising [15]. For example, an investigation by [16] showed how one teenager creating fake news that favours both Trump and Clinton earned him tens of thousands of dollars in the 2016 elections. A study by [11] shows that the average U.S. adult read and remembered one or more fake news stories, while the ones with a disposition not to verify news origin are likely to accept Fake News. Research has determined that Fake News would have changed the vote share by an amount on the order of hundredths of a percentage point; the authors stated, 'Thus if one fake news article was about as persuasive as one TV campaign, the impact on the US voters would have been measurable' [17]. The conclusion is that this change would have likely affected the results of the U.S. presidential election.

One of the measures taken by social media platforms is the closing down of fake profiles [18]. For example, Twitter has blocked some accounts which are related to Russian users and those connected to them. Facebook is constantly improving its algorithm to check the quality of the process of publishing news. Mark Zuckerberg has stated that less than one per cent of the content on Facebook is not authentic [19]. In fact, a study by [19] showed that by mid-2019, Facebook had closed millions of accounts that are believed to be fake and other reports suggest that the platform has closed over three billion accounts for that reason.

Another approach that has proved partly successful is the use of third-party checkers, usually independent journalists who validate or rebuke trending news posts but whose role seems to have been expanded to review images and misplacement or context issues. A 'fact check' link has been attempted to be added to news articles by Google News, but Google has not gained much from that because now the articles are linked to reliable news outlets as they were posting reviews of fake news [1].

D. Fake News as deepfakes

A deepfake is media content that is partially manipulated or completely fabricated by an A.I. (Shick, 2020). Due to the recent advances in technology, A.I. now has the ability to change media content to a very precise degree, making it almost indistinguishable from reality. Evidence shows A.I. use in videos, images, pictures, animation, etc. As Shick (2020) describes, this can have many positive applications in movies and video games to make them more real and spectacular, but it also has the ability to be used as a weapon.

When it is used with malicious intent or as purposeful misinformation, synthetic media is called 'deepfake' (Shick, 2020). Due to the fact that it is still so new, there is not a single consensus on the meaning or definition, but that is the one that will be used.

So far, the successful use of Deep Fake for malicious activities has been called out quickly by the media. A famous example of a deepfake is a video on YouTube, which has many millions of views, which presents a 'demo' of a Deep Fake where ex-President Barack Obama is in the White House and sitting in a chair, looking directly into the camera and saying some things that he never. This video quickly went viral, and it is claimed that initially, people believed it was real because, to the naked eye, it is very life-like in every way.

E. Gaps in the literature

Fake News is an ever-evolving concern, as we advance with technology and society, so will the fake news. We can see from history how every time something is invented, such as the printing press, as much good as it does for the advancement of humanity, it also introduces another means for people to use to make different fabrications and all kinds of fake content, for the sake of profit or personal satisfaction.

Currently, communities and individuals are shocked by the great potential and harmful impact Deep Fake could have. It is only a few years old in terms of an idea, but it has changed vastly thanks to the Internet and general technological advancement in the computing sphere. On the one hand, AI makes it easier to create and generate fake videos that are realistic looking and hence well received by the audience. On the other hand, various researchers are using AI techniques to detect deep fake videos. For instance, Li, Chang and Lyu [24] utilised an advanced artificial neural network technique that uses eye blinking in the video to decide whether this particular video is fake or authentic. Similar research attempts are also evolving. However, accurate identification of AI-generated fake videos remains challenging due to the rapid development of AI tools.

An additional example of the recent relevant AI advancements is represented in what is known as "Synthetic Text". In [25], researchers developed their framework titled "Generate, Annotate, and Learn (GAL): NLP with Synthetic Text". In the GAL framework, researchers utilised language models as a source of synthetic un-labelled text that will be fed into Natural Language Processing (NLP) algorithms later. Their framework generates high-quality and task-specific text through one of the following approaches. First, either by tuning available language models (e.g., similar input text or prompt large language models). Second, by using their supervised machine learning model that represents a combination of labelled and pseudo-labelled data. Their work provides successful results according to their evaluation. This research, along with similar

attempts, provides ground-breaking development since they are developed and deployed by a relatively small number of researchers compared with giant language models such as ChatGPT.

However, Fei [26] addressed the same problem in a very innovative way. They used motion discrepancy to differentiate AI-generated fake videos from real ones. Technically, face motion amplitude will be magnified to identify any serious distortion in videos, which will be then recognised as fake video. The presented approach has been evaluated against Faceforensics++ fake video dataset and outperformed similar existing pixel-based fake video forensics approaches.

In the next section, we will introduce the actual methodology of conducting this research.

III. Project Methodology

For this paper, the methodology involves the development of two short Deep Fake videos integrated with A.I. and then showcasing this video along with one factual clip of a lecture to a selected group of Computer Science students to test if they are able to identify the factual video from the deep fake ones. The students needed to be made aware of how many of the videos were factual or otherwise. To complete this project, we trained an A.I. algorithm to learn from selected practices the behaviour and movement of the lecturer.

A. Deep Fake Development Methodology:

We used an Agile system development approach. Agile, as shown in Fig 1 below, is a software development process that promotes iterative development for IT solutions based on active user involvement throughout the life cycle of the project.

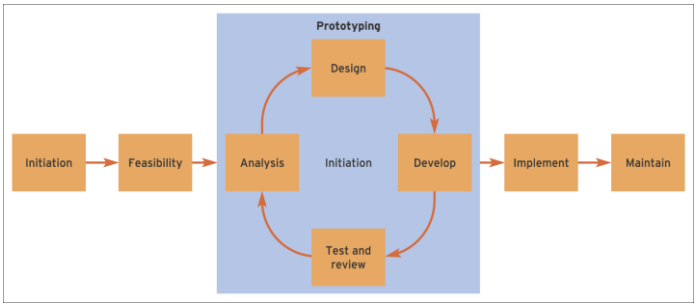

Fig. 1. Rapid Application Development figure. [20, p.261]

Because A.I. training requires several iterations of development, Agile methodology represented the best approach for this development. The agile method emphasizes working software as the primary measure of progress [20].

In the initial stages, we agreed on the time scale and objectives of the application and reviewed current applications to decide the most appropriate approaches that have the best chance of succeeding, including agreeing on a feasible approach.

After the first two stages, the team used the prototyping phase to analyse the requirements and design part of the project. Afterwards, an initial development of the design is made, which has to be tested and reviewed. This stage involved A.I. training that took several iterations. When the review is concluded, another analysis occurs to decide whether or not it needs a re-design and so on until the videos are completed.

For the purposes of this project, which is a Deepfake Fake News video, we used several different Deepfake A.I. algorithms created by DeepFaceLab (SAEHD Model generator) combined with a custom-made Python Script algorithm, which underwent multiple designs and developments in a prototype form until a convincing enough video is produced. This was followed by using and implementing that approach to see to what extent our study sample, i.e., computer science students, can discern that from a real video, and finally have revisions and maintenance, until satisfactory results. Later, results have been investigated, further analysed and then disseminated in a report.

B. Survey Design

In order to collect feedback from as many students as possible, the team decided to use an online survey as a faster, cheaper, and safer approach [21]. The students who were invited to participate in the surveys received them through email or class announcement. In total, 626 students were invited from across all levels of the Computer Science subject area at the University of East London. The main rationale behind selecting Computer Science students as a sample for this experiment is their familiarity with the technology and their intimate belief that various concepts can be faked. Hence, the expected outcomes of this experiment are expected to be more genuine and authentic.

To be able to get efficient and meaningful results, the team conducted a pilot study first, allowing students to engage with the videos before answering a series of questions. This allowed questions to be structured and focused by rephrasing some questions and allowing a good balance of open-ended and closed-ended questions. The survey starts with general questions to put the demographic into some categories and then moves on to showing them the videos and asking questions about their experience with each video. It includes multiple stages, making notations along the way. The analysis is done using the quantitative approach.

C. Challenges and limitations

For the creation of a realistic deepfake fake news video, it required significant time to train the different A.I. models for using and testing the different outcomes, as well as having to put that into video editing software to achieve the side-by-side effect.

Additionally, an important limitation to be noted is the fact that we had to conduct the survey in two stages, as there first round did not collate a sufficient number of responses. Because students invited expected that they were going to be exposed to factual and fake videos, some may argue that there would be a disposition where the respondents would be examining the videos closely. Moreover, some of the final-year Computer Science students would technically be more aware of the role A.I. and Deep Fake. Nevertheless, the team determined that this experiment in itself a proof of how powerful this tool could be even when tested against altered and well-informed higher education students.

D. *Ethical Considerations*

All participants in the research project were informed of their rights and agreed to the online consent form before conducting any experiment.

For the survey, the data was collected anonymously, without the use of any personal details that may be used to identify the participants. The data is presented in an aggregate quantitative format and stored in compliance with UK GDPR. Thus, the survey was conducted within the University's own Microsoft Forms, which stores the information securely and can be accessed only with the account that has created the survey.

Every care was taken in creating the deepfake fake news videos. The team made sure that the changes in the lecture content were harmless and could not be reused or misused. Participants were informed that they would be subjected to several videos, including some deepfake, and as part of the consent, they could stop the study at any point. The team chose three videos welcoming students to the lecture and making a short announcement about the upcoming exam. The deepfake video announced the following lecture was cancelled because of a staff strike, which would have been plausible in the Winter of 2022. The students, after completing the exercise, were not informed of the Deepfake video until the survey was concluded to stop the cross-sharing of information.

IV. Findings

The findings demonstrate the development of the Deep Fake videos and the ever-increasing ease of the process. Then we present the results of the survey.

A. *Deepfake Software FaceSwap vs DeepFaceLab*

After evaluating several approaches to the creation of Deepfake, two software applications proved to be easily accessible in the creation at the time of writing this paper. One of those is FaceSwap, and the other one is DeepFaceLab. DeepFaceLab suggests that it is used for 98% of the creation of deepfakes and FaceSwap is 'something that was before DeepFaceLab and still remains in the past' [22]. The team used FaceSwap for having more user-friendly tools, alongside many more advanced options compared to DeepFaceLab, which does not have a Graphical User Interface (GUI). Both applications use Python as their base for the machine learning part and A.I. algorithms; additionally, both rely on one of the biggest libraries that exist in the Python programming language – Tensorflow. The team started with both applications and made use of each in different ways.

Fig. 2. Before.

Fig. 3. After.

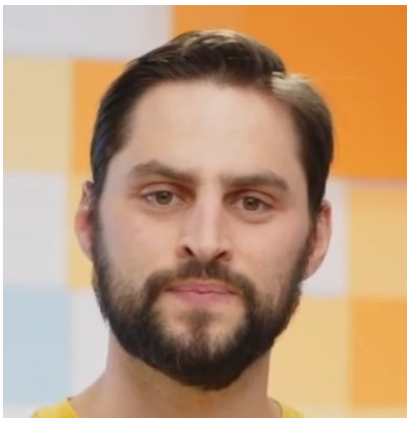

Fig. 4. The face used to make the deepfake.

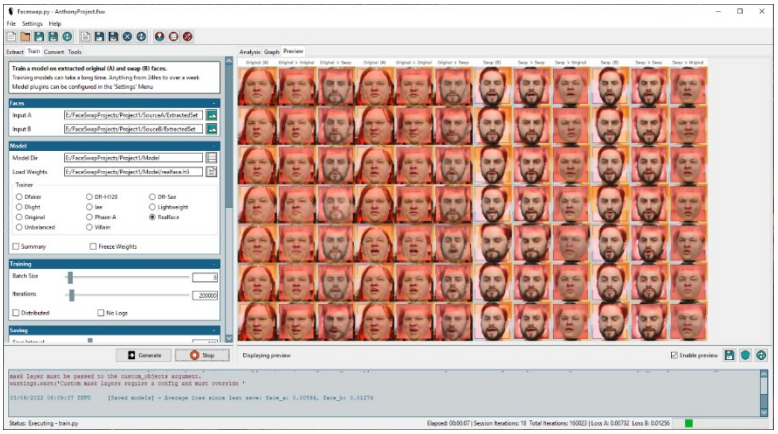

Fig. 5. Training the model. Currently on 160,000 iterations.

After completing several iterations and prototypes on FaceSwap, the team recognised several limitations demonstrated in Figures 2 to 5. The software, while playing a considerably good role in swapping the faces, the swap is not smooth and could still be detectable. Thus, the team decided to complement the videos with the use of DeepFaceLab. After considerable iterations using both software tools, the team felt the final product could have been more convincing as such, and while continuing the Agile process development, the team decided to experiment with another software.

Fig. 6. Extracted face detection and mask, similar to the process of FaceSwap.

B. Roadblock working with Deepfakes and Wav2Lip

In essence, the process involved Deepfaking the same individuals using words mentioned in another context and replacing the context with another lecture and even a completely different subject. For this to work, the movement of the face, the talking and the movement of the lips had to be synchronised with the conversation. There are two options that could be done. One was to simply use the Photoshop application video editing tool, but this is a laborious process.

To speed up the process, the team used DeepFaceLab 'Avatar'. Using several prototypes, the output achieved near-perfect seamless swap through a process called 'erosion'. However, the rending proved difficult. The rendering process required server-level processing power. Also, the process did not produce the quality required because the outcome did not flow seamlessly.

The team finally decided to use Wav2Lip. While this application does much of the earlier work in swapping faces, it has mastered the art of A.I. integration that allows the face movement to integrate with what the new words are saying, see Figures 7 and 8. In other words, the outcome proved to be a more targeted way with fewer resources, to achieve almost better results than other software that we tested.

Model	Description	Link to the model
Wav2Lip	Highly accurate lip-sync	Link
Wav2Lip + GAN	Slightly inferior lip-sync, but better visual quality	Link
Expert Discriminator	Weights of the expert discriminator	Link
Visual Quality Discriminator	Weights of the visual disc trained in a GAN setup	Link

Fig. 7. Some of the available pre-trained models for use from the GitHub Page. [23]

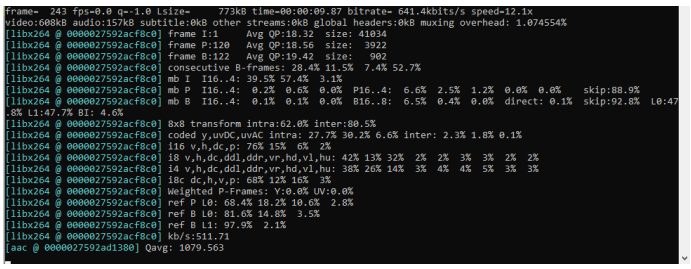

Fig. 8. Compilation of the end result into a video within the command line window (CMD).

Some limitations are detected in the outcomes and may be attributed to the rendering power of our systems. Figures 9 and 10, show the pixelation difference between face movements before and after. However the team determined that this was hard to spot on the phone and more so in online lectures with lower resolutions, such as MS Teams video recordings, see figure 11. As such, the team decided to go ahead and conduct the experiment.

Fig. 9. Screenshot from the output

Fig. 10. Screenshot from the original

Fig. 11. Screenshot from an MS Teams meeting to showcase the quality in normal circumstances.

V. SURVEY RESULTS

The survey was published in the Fall of 2022/03 and has been active for a month. During that period, we targeted some 626 students but accumulated a total of 179 (26.8%) responses. The following are the main findings from the survey:

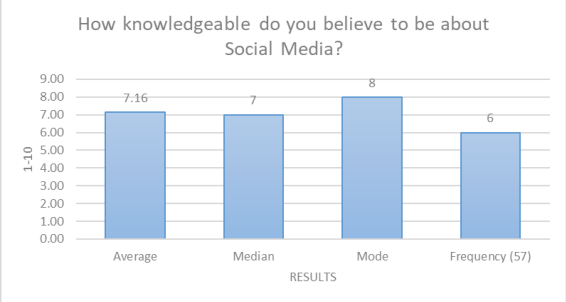

Fig. 12. Chart – Average respondent has good knowledge of Social media

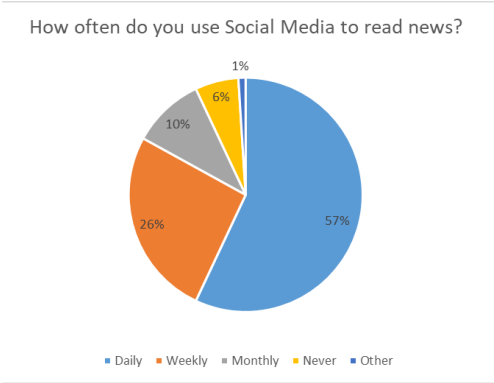

Fig. 13. Chart – 57% Check their news on Social Media

Fig. 14. Word Cloud to an open-ended question on Fake News.

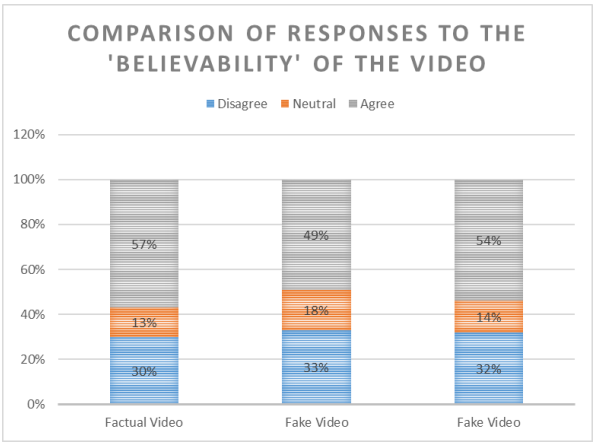

Fig. 15. Chart - Comparison of three answers to videos' believability

Figure 12 shows that the average computing science student self-reporting a 7.16 score (Very good) knowledge of social media while Figure 13 shows 57% of students rely on social media for their daily news. This latter figure is significantly higher than a similar survey conducted in 2020 that showed 40% of higher education students in the UK relying on Social Media for the news [27]. The main difference between the 2020 survey conducted at Queen Mary University is that the survey cohort came from across all disciplines, whereas this survey is specific to Computer Science students. In addition, an open-ended question asked students to describe what they think of the subject of 'Fake News'.

Our word cloud analysis of the responses (Fig 14) suggests the majority (61%) understand it in general terms as misleading information or false news. The most repeated terms are: fake, false, misinformation, inaccurate, and misleading, respectively. Around 11% indicated they do not understand it or do not see it as harmful.

The key outcome of the survey is the responses to spotting deepfake videos. The students were not aware of how many of the three videos were likely to be fake. All three could be fake, two could be fake, one could be fake, or none are fake. On an individual basis, there are some indications from comparing the results in Fig.15 that significantly more respondents indicated the factual video to be true. However, the data shows students very much mixed and matched across the other answers resulting in confusion as to which video, if any, is fake.

In fact, data shows 44 respondents (24.5%) agreed that all the videos are factual as well as 12 respondents (6.7%) believed all the videos are fake, and a further 28 respondents (15.6%) had a combination of believing or not believing everything when their only other selection is neutral, of example: Believe two videos but being unsure of the one. Since the first video was the only factual one and the other two were fake, only 13 respondents (7.2%) had actually spotted the correct combination. A further 5 respondents (2.8%) have close answers, for example, believing the first video but being either neutral or disagreeing with the remaining. What we conclude from the analysis is that the majority of respondents failed to get the correct combination and that in fact, The total number of possible combinations of three responses Strongly Agree/Agree (A), Strongly Disagree / Disagree (D), and Strongly Disagree / Disagree (D) as A,D,D combination is 3^3 = 27. This is because there are three choices for each letter, so there are 3 * 3 * 3 = 27 possible combinations

The number of combinations that include the sequence A,D,D is 3. Thus, the probability of the respondent randomly getting the sequence A,D,D is 3/27 = 1/9. This is because the number of successful outcomes divided by the total number of outcomes (27) is 1/9 or 19.9 respondents. If rounded to 20, a number that is less than the 13 respondents who got the answer correct even but very close to the total received, including close combinations (18). This conclusively proves that the quality of the deepfake videos was such that it is very likely those who did indicate the correct sequence did so randomly.

VI. Conclusion

A. Key Findings

Deepfake videos are a much bigger challenge than one would have expected. It is evident that even individuals in higher education and well versed in the use of technology and further informed to look out for deepfake failed to do so. The outcomes did surprise the team.

Much of the software needed to create deepfake is open-source and accessible. Several are written entirely in the Python programming language, an accessible programming language that would allow intermediate programmers greater facilities to edit and machine learn the process. The results have shown that a deepfake video with a quality that is hard to detect using mobile devices can result in sufficient confusion among its viewers. This paper showed that even higher education students with very good knowledge and regular reliance on news via social media cannot tell fact from fiction.

B. Limitations:

There were limitations of this project, those mainly being time and for the creation of a normal deepfake, you will require multiple days, even up to a week, to create one attempt with the software available due to the requirement of computing resources. Ideally, such a project would have been better rendered on a server with significant resources, but the team could only do it on personal machines. This had an impact on processing time and the quality of the rendering. Another area for improvement is that the survey itself was conducted with a specific cohort and thus would not be suitable to generalise the outcomes. Finally, despite the sample being a significant number, the sample cannot be generalised on.

C. Implication of the project and survey

The challenge with fake news is that the creators of fake news are determined to do whatever they can to influence elections, referendums, and news whenever they can. Thus, as social media responds by developing tools to control it, it is natural to expect the content creators of fake news will attempt to move the goal post. This paper has demonstrated that the use of deepfake is and could further be challenging. There are indications that the use of big data and targeted social media messaging services could be weaponised using Deepfake [28].

D. Future work

It is strongly recommended that a full-scale survey capitalise on the findings of this study. Specifically, consideration of factors such as cognitive bias in how individuals process deepfake videos. What differences in background, education, and socio-economics can have on individuals who are faced with different and conflicting deepfakes? This is critical as we move forward with big political tests ahead of several national and international elections in 2024.

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