Facial Classification Technologies in Advertising

Adrian Pesch
Technical University of Munich
Munich, Bayern, Germany

Po Chieh Lin
Technical University of Munich
Munich, Bayern, Germany

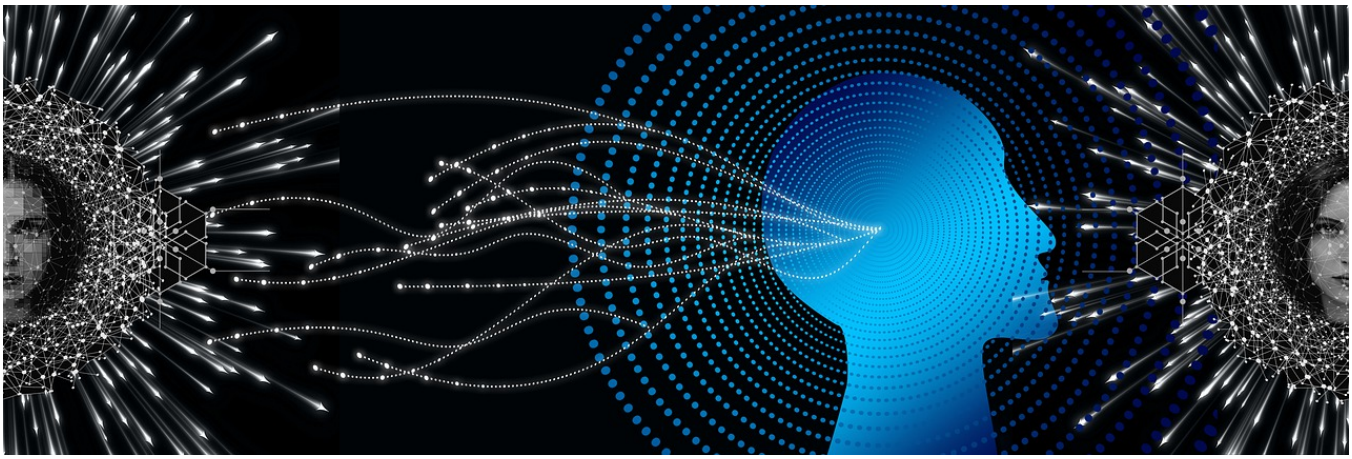
Ege Kurt
Technical University of Munich
Munich, Bayern, Germany

Nicole Kubitza
Technical University of Munich
Munich, Bayern, Germany

Caner Karaoglu
Technical University of Munich
Munich, Bayern, Germany

Achraf Labidi
Technical University of Munich
Munich, Bayern, Germany

Markus Vrancea
Technical University of Munich
Munich, Bayern, Germany



ABSTRACT

Facial classification technologies are a type of artificial intelligence that can recognize and classify human faces based on various characteristics, such as age, gender, and emotions. This technology has become an important tool in the advertising industry, with applications ranging from targeted advertising to audience analytics. In this paper, we will discuss the various application areas of facial classification in advertising and showcase FaceMe, an example use case of the Facial Classification Technologies (FCT). We will also address the issue of data biases in FCT and present ethical considerations for their use. To demonstrate the practical applications of facial classification technology, we have developed a web application that demonstrates facial classification in advertising. Through the web app, we also conducted a survey where we collected data from 51 participants and analyzed their attitudes toward the use of such technology. The majority of participants rejects the usage of FCT to provide personalized advertisements or to be used in the hiring process, while more than 66% disagree with widespread usage in public surveillance. Our findings highlighted the potential benefits and drawbacks of using FCT in advertising and made us think about future improvements for our web application and to this field.

KEYWORDS

Facial recognition technologies,Facial classification technologies, Ethics, web application, advertisement

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1 INTRODUCTION

FCT are types of biometric technologies that use Artificial Intelligence (AI) to analyze and classify images of human faces based on certain characteristics, such as the shape of the eyes, the distance between the nose and mouth, and the width of the jawline.

These features are then used to classify the face, i.e. regarding age, emotion, gender, or race.

This technology is often used in conjunction with Facial Recognition Technologies (FRT), which is a related but distinct technology that involves identifying specific individuals in a database.

FRT and FCT have the potential to be very useful for a variety of purposes, but they also raise privacy concerns and have been the subject of controversy due to the potential for misuse and the potential for bias in the algorithms or data. Some people are also concerned about the accuracy of the technology, as it can sometimes have difficulties accurately classifying people of certain races or ethnicities. As a result, the use of FCT is regulated in some countries and is the subject of ongoing debates about its appropriate uses and potential impacts.

In the following Section 2, application areas are discussed to give an insight into facial classification-specific use cases in real life. Section 3 covers FaceMe, a collection of FRT solutions for companies and private persons. It's an example of where FCT is currently used in real-life. Subsequently in Section 4, ethics comes into focus to highlight potential issues with the advertisement part.

In Section 5 we introduce our web application that aims to inform users about FCT, how they work, where they are currently being used, and the potential dangers associated with their use. The web application uses a didactic approach to convey information about FCT and the concerns raised by non-governmental organizations, by demonstrating the technology in action, explaining the underlying science, and posing questions to the user. As users progress through the demo, they have the opportunity to build upon their knowledge and understanding of FCT and the issues surrounding their use. During the first visit to the web application, the user is guided through the page and should fill out a survey, the results of which we present in Section 6. Section 7 gives an outlook of possible and important improvements to the web app that should be implemented to convey the message more effectively. Lastly, Section 8 covers the key takeaways which the group noticed in the complete group phase of the seminar.

2 APPLICATION AREAS

Facial recognition and classification technologies are widely used in many aspects of our life. Many Organizations are using FCT to collect biometric data and provide personalized experiences for customers. The goal of these efforts is to enhance the customer experience by providing increased personal relevance and tailoring the marketing mix to individual customers The following part will elaborate on the usage areas of FCT.

2.1 Law Enforcement

In law enforcement, not just facial detection and verification technologies are used to identify criminals, but also FCT. Since the faces of people are the mirror of their inner minds, potential crimes can be prevented by intelligent systems using emotion detection (in combination with behavioral analysis). The police can deploy the technology in the surveillance system of the city and keep an eye on potential criminals. "According to criminal psychologists, the tendency towards emotional-driven crimes falls on nine levels: bothered, annoyed, indignation, frustrated, infuriated, hostile, wrath, fury, and rage. Once their emotion reaches the hostile level or above, a person will be consumed by the fierce emotion, failing to remain sober-minded or strictly control their behaviors." [14]

2.2 Advertisement

Using facial recognition and classifying technologies consist of intelligent agents that recognize a customer's face and provide ads that change dynamically based on a person's interests and emotions. This technology offers precisely targeted ads similar to personalized internet ads. The demo page of the implemented website illustrates a replication for this usage of FCT (see https://frt.gg.ht/demo).

2.3 In Working Environment

The use of biometric data may be used to improve employee hiring, support, and management practices. Biometric data can be used to assess potential candidates through a "biometric resume" [5] that includes a physical, behavioral, and emotional profile. In addition, biometric data can be used to enhance the performance of frontline employees. For example, using emotion recognition software in call centers has been shown to improve interpersonal emotion regulation and affective well-being for employees. Tracking biometrics during work can also provide real-time feedback on employee behavior to enhance performance. For instance, data patterns are revealed that allow call center workers to take breaks together, leading to lower stress levels and higher employee satisfaction as well as resulting in lower turnover rates. Biometric data can also be used to evaluate the quality of customer service provided by employees. However, it is important to use biometric data in a responsible manner, as it may put a strain on employees.

2.4 Other Application Areas

FCT is widely used in various industries for a variety of purposes. In the hospitality industry, FCT is used to identify customers and review their profiles to provide personalized greetings. The automotive industry also employs FCT to decipher drivers' emotions and create personalized driver's spaces. Insurers are using FCT to track biometrics related to health conditions, fitness, and individual differences to personalize life insurance policies and reduce costs[5]. CyberLink's software FaceMe is known to cover many of these application areas.

3 FACEME

The main goal of this study is to investigate the potential of using facial expression tracking technologies to gather demographic information and assess the emotional state of in-store shoppers. The objective is to utilize this information to personalize the shopping experience and deliver targeted marketing messages to customers based on their facial expressions. In pursuit of this objective, we examined the capabilities of FaceMe, a FCT solution offered by CyberLink.[4]

3.1 General information about FaceMe

FaceMe is a product of the company CyberLink that provides facial recognition and facial classification technology. The company offers a range of products and services including facial recognition software for security and surveillance, customer service and

marketing, and identity verification. According to the company's website, its accurate, fast and scalable technology can be used in a variety of industries and applications. [4]

One area where FaceMe's technology has been widely adopted is security and surveillance. The company's facial recognition software is used by law enforcement agencies and private security firms to identify and track individuals in real-time. It is also used in airports, train stations, and other public spaces to enhance security and identify potential threats. While these applications have the potential to improve public safety, they also raise concerns about the potential for misuse and abuse of the technology, as well as the impact on privacy.

In addition to its use in security and surveillance, FaceMe is also used in customer service and marketing. The company's facial recognition software is used by retailers to identify customers and personalize their shopping experiences, as well as by advertisers to target specific demographics with personalized advertisements. These applications have the potential to improve the customer experience, but they also raise concerns about the potential for the technology to be used to track and profile individuals without their knowledge or consent.

3.1.1 Provided services. According to the company's website, FaceMe provides a range of FRT and FCT products and services. These include:

- Facial recognition software: FaceMe's facial recognition software is designed to identify and track individuals in real-time using images or videos from cameras or other devices. It can be used for security and surveillance, customer service and marketing, and identity verification.
- Facial classification software: FaceMe's facial classification software is designed to classify images of human faces based on certain characteristics, such as age or gender. It can be used for marketing, security and surveillance, and other applications.
- Identity verification: FaceMe's facial recognition technology can be used for identity verification, allowing users to securely access accounts or services using facial recognition.
- Customer service and marketing: FaceMe's facial recognition software can be used by retailers to identify customers and customize their shopping experiences, and by advertisers to target specific demographics with personalized ads.

In addition to these products and services, FaceMe also provides support and training to help customers implement and use its technology effectively [4].

3.2 Used data by FaceMe

According to the information available on the company's website, FaceMe uses artificial intelligence (AI) algorithms to analyze and classify images of human faces based on certain characteristics, such as age or gender. To do this, the company uses a large dataset of images of human faces that have been labeled or annotated with specific characteristics [4]. The exact nature of the data used by FaceMe to classify faces is not disclosed on the company's website. However, it is likely that the data includes a diverse range of images of human faces from various racial and ethnic groups, as well as a range of ages and genders. The data may also include images of people with different facial features, such as facial hair, glasses, or makeup. To ensure the accuracy and fairness of its facial classification algorithms, it is important for FaceMe to use a diverse and representative data set of images. This can help to minimize potential sources of data bias (see Subsection 3.3), such as sampling bias or measurement bias, which can lead to inaccurate or distorted results. It is also important for FaceMe to ensure that the data is labeled or annotated accurately and consistently, using objective and unbiased criteria. This can help to ensure the accuracy and fairness of the classification algorithms [11]. Protecting the privacy of individuals whose images are included in the data set is also essential, hence if details are to be revealed, it should be quite general and focus on the distribution of age and gender groups or how the accurate recognition of different ethnic groups is warranted. Through transparency, data bias may be prevented [3].

3.3 Data Bias

Data bias in facial classification refers to the systematic and often unconscious ways in which the data used to train and test facial classification algorithms may be skewed or unbalanced, leading to inaccurate or distorted results[7]. Data bias can occur at various stages of the data collection, analysis, and interpretation process, and can have serious consequences for the accuracy and fairness of the results. One potential source of data bias in facial classification is the sampling process used to collect the data. If the data used to train and test the algorithms is not representative of the larger population, it can lead to conclusions that are not accurate or can not be generalized. For example, if the data is disproportionately made up of images of people from a particular racial or ethnic group, the algorithm may be more accurate at classifying people from that group but less accurate at classifying people from other groups. This can result in a phenomenon known as sampling bias, which occurs when the sample of data is not representative of the larger population. Another potential source of data bias in facial classification is how the data is labeled or annotated. If the data is labeled or annotated in a biased or inconsistent manner, it can lead to inaccurate or distorted results. For example, if the data is labeled using subjective criteria rather than objective criteria, it can lead to errors in the classification of the data. This phenomenon is known as measurement bias, which occurs when the tools or methods used to collect data are flawed or biased, leading to inaccurate or distorted results. It is important to be aware of potential sources of data bias in facial classification and take steps to minimize them to ensure the accuracy and fairness of the results. This can include carefully selecting and curating the data used to train and test the algorithms and using objective and unbiased criteria for labeling and annotating the data.

3.4 Replicating FaceMe

As we have no access to FaceMe we used DeepFace, a lightweight framework for Python that analyzes age, gender, emotions, and other facial attributes. Many models, including VGG-Face, Google FaceNet, OpenFace, Facebook DeepFace, DeepID Dlib, and SFace, are implemented by this framework [12]. The model we employed to analyze the facial attributes and simulate some of the functionalities that FaceMe can provide is "Facebook DeepFace". However, it

is important to consider the potential impacts and consequences of using FRT, including the potential for privacy violations and the potential for biases or inequities in their use. It is also important to ensure that any implementation of these technologies is done in an ethical and responsible manner, with appropriate safeguards and protections in place. Facebook has faced criticism and controversy over its use of FRT, and it is important to carefully consider the potential consequences of any implementation of these technologies.

4 ETHICS

As we briefly mentioned in the previous sections, there are some ethical and societal concerns in FRT that have been a topic of discussion for years. These debates are carried out by both governmental and non-governmental organizations. In general, they mostly focus on issues such as discrimination and social awareness, which are the result of the concerns of society. The fact that these technologies are frequently used without permission or notification is a fundamental ethical problem with facial recognition. Although you may access security cameras or video feeds of workers, clients or the general public, that doesn't mean it is a good idea to use that information without first notifying the concerned parties[6] and asking for their consent. Not all ethical controversies known and resolved in this field are the subject of this paper, but we will discuss the ethical concerns and possible solutions in advertising, which is the subject of our didactic web application.

As a result of the false advertisements shown in the demo related to age ranges, displaying content that may be harmful to the masses due to inappropriate age ranges may lead to dangerous consequences such as addiction in people in this age range in the short term and change in norms in the long term. In high-budget applications, in any wrong criterion evaluation, the budget directions of the advertising providers may deviate based on these results and losses may occur.

4.1 Neuromarketing and Areas of the Brain

Neuromarketing is a type of sales technique that uses the brain to create a sense of motivation in the mind. It uses manipulative techniques to encourage you to buy something by appealing to your subconscious. However, regardless of the technique employed, the stimuli presented outside of the conscious mind are formatted to manipulate the viewer by targeting one's autonomic arousal or emotional state, making it biologically more difficult for the subject to reject the effects of the advertisement. This is especially true because the brain prioritizes emotional information. When a person only sees a product in a store, an emotional peak develops within the brain. This emotional high affects various areas of the brain, some more than others. The prefrontal cortex is the area of the brain responsible for this type of excitement. Major brands like to use methods that target the prefrontal cortex to subconsciously cause the viewer to associate their product with positive cognitions, changing the pattern of brain activity to cause the viewer to believe that they truly enjoy the product when, in fact, they may find it mediocre or simply dislike it. This type of advertising is processed in stages, with each step leading to the next: cognition → affect → behavior. The advertisement makes you think about it, and if it is effective, it will elicit certain emotions associated with the advertised product. If those emotions are strong enough or positive enough, a person is more likely to act on them and buy the product.[9]

4.2 Ethics of Facial Recognition Technologies

There are numerous ethical concerns surrounding the use of FRT, including privacy, accuracy, transparency, autonomy, and bias. It is important for companies and organizations using these technologies to consider these ethical concerns and take steps to mitigate any potential negative impacts.

4.2.1 Lack of transparency and consent. The fact that these technologies are frequently used without consent or notification is a fundamental ethical issue with facial recognition. Having access to surveillance cameras or video feeds of employees, customers, or the general public does not imply that it is a good idea to use that data without first informing the parties affected. Identifying someone by their face opens the door to access a lot of other data, which can amplify ethical concerns. Should you, for example, use facial recognition to identify people entering a store and then use that identity to pull purchasing history? Would you like a credit report? Should you avoid serving customers with low credit scores in favor of "high value" customers? [10]

4.2.2 Racial discrimination in law enforcement. The US Federal government recently published a report that confirmed discrimination problems with their facial recognition systems. For the faces of middle-aged white men, the algorithm typically performed well, but it performed poorly for those of people of color, the elderly, women, and children. These racially biased, clumsy algorithms can cause havoc, leading to unjustified arrests, protracted detentions, and even lethal police violence. In order to identify people using face recognition algorithms, law enforcement organizations like the United States Capitol Police rely on mugshot databases. This creates a feedback cycle where racist policing tactics lead to disproportionate numbers of unjustified arrests. Data on facial recognition is not excellent overall. Penalties for crimes that were not committed could follow from it. For instance, a little adjustment to the camera position or one's look, like a new hairstyle, can result in mistakes [8].

4.2.3 Personal Data Risks Associated with Face Recognition. People have been using face detectors in their cell phones, laptops, and personal computers for several years. Because PCs, laptops, and cell phones all contain personal data and information, this technology has created a number of risks to data privacy. Identical twins, as well as individuals with similar facial features, can readily access the information of a person by taking advantage of the flaws in face recognition technology. As a result, the data on a PC or cellphone may be accessed in unethical ways. [1]

In general, errors that cause faulty systems can be divided into many categories, such as incomplete or feature-based unstable data sets, undesirable mistakes that can be made during the development of face recognition software, and the fact that the software does not raise awareness in the people who will be exposed. These errors may not only reduce individuals' trust in that software but may also lead them to take some attitudes against their use or to be in organizations that take these attitudes.

There is currently a lack of consensus regarding models of emotion and the respective proxy data that is used to represent emotional experience. While there are many models and proxy data available, these do not consider all aspects of emotion. There is a problem of plenty and parts and the issue of understanding the role of different parts. The collected data from these models and proxy data often leads to the creation of implicit norms and values, which can potentially shift the norms and values of people towards those of the system providers. The normative weight of emotion on human action is crucial, and there is a call for the regulation of AI systems that deal with emotion. There is also a problematic gap between motivational and experiential/evaluative theories of emotion. The BET (beauty-emotion theory) is widely spread, but using people's outer appearance to infer their inner character is generally discredited. Social media companies have been known to experiment with emotion, which can result in political polarization (especially performed by external companies). The ecological fallacy, or the error of considering correlations of variables in aggregate at the individual level, is also a concern when it comes to understanding and working with emotion. [13]

Table 1: Age intervals and corresponding advertisements.

age	advertisements
0-10	fast food, sweets, mobile games, toys
11-15	fast food, sweets, mobile games, clothes, tech
16-17	fast food, sweets, mobile games, clothes, tech, wine, beer, sweet alcoholic beverages
18-25	fast food, sweets, mobile games, clothes, tech, wine, beer, sweet alcoholic beverages, CBD products, cigarettes, vaping, hard alcohol, gambling
26-40	fast food, sweets, mobile games, clothes, tech, wine, beer, CBD products, cigarettes, vaping, hard alcohol, gambling, cars, workout gear
41+	fast food, sweets, mobile games, clothes, tech, wine, beer, CBD products, cigarettes, vaping, hard alcohol, gambling, cars, workout gear

5 CONCEPT

While the majority of people still do not understand the possibilities of AI and lack understanding of how it will influence themselves, as was made clear in the preceding sections that FCT is still playing a significant role in society today. In order to introduce FCT to the public, we create a web application that aims to deliver the following messages:

- What is FCT, and how it works.
- An application example of FCT.
- The consequence of using FCT.

5.1 User journey

As part of this study, participants will be asked to browse through four pages on our website: introduction, demonstration, theory, and about us. Between each pair of pages, they will be required to complete a survey to assess any changes or evolution in their attitude towards the topic. There are three surveys in total. This will allow us to track the impact of the information presented on their perspective.

5.1.1 Introduction page. To ensure that this information is accessible to all, we have made sure to keep this page as straightforward as possible. It includes a brief introduction, our motivation for creating this resource, a short explanation of our demonstration, and a list of the tools we used. We recognize that not everyone may be familiar with FCT, so we have made an effort to present the information in a clear and concise manner.

5.1.2 Demo page. The demonstration page of our website allows users to access their webcam and capture a photograph of their faces. This photograph is then used by deepface in the backend to generate classified information, including age, gender, race, and emotion. These results are displayed to provide users with an understanding of the capabilities of FCT. Additionally, simulated advertisements are generated based on the age of the classified data as presented in Table 1, offering a glimpse into how targeted advertisements can be created in the real world. The shown advertisement pictures were created specifically for this application, so they would not refer to specific brands and could be viewed as dummy ads. An additional benefit is the coherent look of the images. This demonstration serves to prompt users to consider the potential applications and implications of FCT, and whether they are good or bad depending on the situation.

5.1.3 Theory. In order to provide a more thorough understanding of FCT, we also offer a deep diving section on our website. This section delves deeper into the inner workings of the technology, allowing users to gain a greater understanding of how it functions and operates.

5.1.4 About us. On this page, the focus is on introducing the circumstances of the project. From this page onward, the user will be able to freely browse the website without the need to complete any further surveys.

5.2 Application: Advertising

On the website, we aimed to show the potential impacts of using FCT in advertising. By using hidden cameras in a shopping center, for example, retailers can capture customers' faces and use FCT to analyze their age, gender, and emotions. This information can then be used to show targeted advertisements to customers through digital signage.

However, there are potential drawbacks to using FCT in this way. For example, if an old-looking child is wrongly classified as an adult, they may be shown inappropriate advertisements for products such as alcohol or gambling, which could potentially harm their mental health. Additionally, if a person is classified as being in a particular emotional state, such as sadness, the advertisements they are shown may exacerbate that emotion, rather than providing a positive distraction.

Table 2: Questions asked in the survey of our web application.

Question	Question Set
How experienced are you in IT?	1
How familiar are you with facial categorization technologies?	1
How do you perceive facial categorization technologies in general?	1, 2, 3
Do you think facial categorization technologies should be used in public surveillance	1, 2, 3
Do you think facial categorization technologies should be used in advertisement	1, 2, 3
Do you think facial categorization technologies should be used in hiring process	1, 2, 3
How much influence do you think advertisements have in general?	2, 3
How much do you think advertisements influence you?	2, 3
Shall facial categorization technologies be used to suggest personalized ads based on your age?	3
Shall facial categorization technologies be used to suggest personalized ads based on your demographics?	3
Shall facial categorization technologies be used to suggest personalized ads based on your emotion?	3
Shall facial categorization technologies be used to suggest personalized ads based on your gender?	3
Do you understand facial categorization technologies now?	3
What do you think about facial categorization technologies?	3

6 USER STUDY

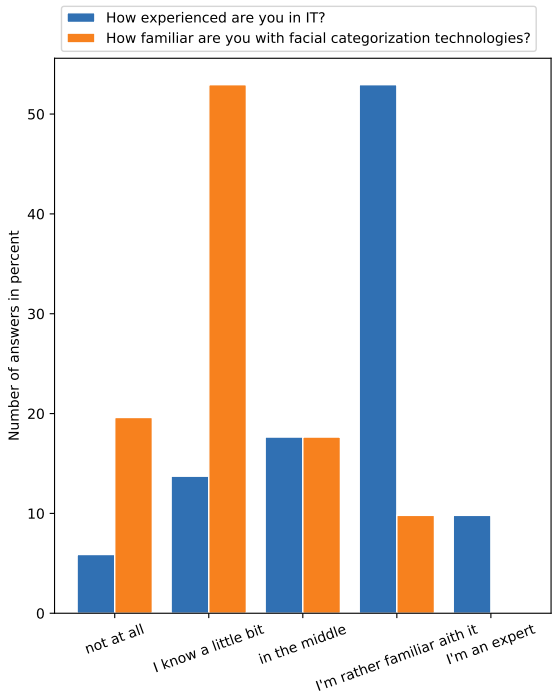

Figure 1: General information about knowledge of survey participants.

Within our web application we included a survey, which we split into three question sets. These question sets contain redundant as well as different questions as shown in Table 2. Question set 1 is shown after the introduction. The user journey continues on submission of the first question set with the demo and afterwards question set 2 is shown. Then the theory part of the web application is presented to the user and finally question set 3 can be filled. Details about the information shown on the intermediary pages are outlined in Section 5. Navigation options are unavailable until all three question sets have been filled, to ensure that the user experience does not change.

6.1 About the Participants

The survey has been filled by 51 participants. The majority are TUM students in the area of computer science, since we conducted the survey in some TUM courses, including but not limited to Chiara Ullstein's seminar *The EU's AI Act Proposal: From framework to practical application*, besides posts in TUM-internal and work chats. Figure 1 depicts the knowledge of participants about IT in general as well as FCT. It can be seen that most participants are familiar with IT but not with FCT.

6.2 Perception of Facial Classification Technologies

As presented in Table 2, we asked four questions in all question sets, to evaluate the influence of our web application on the user's perception of FCT and certain usage scenarios (surveillance, advertisements, and hiring process). The results are presented in Figure 4. No significant change can be observed.

6.3 Facial Classification Technologies in Advertising

We asked questions regarding FCT in advertising, which is depicted in Figure 2. Besides our mistake of having the option *never* twice (one time instead of *always*), it is obvious that the majority of survey participants do not want FCT to be used to suggest personalized advertisements. Especially emotions shall not be considered in advertisements.

A more general perception of the participants about ads is shown in Figure 5. The general influence described by participants does not change after the demo. However the personal influence of ads is described as a little less afterwards.

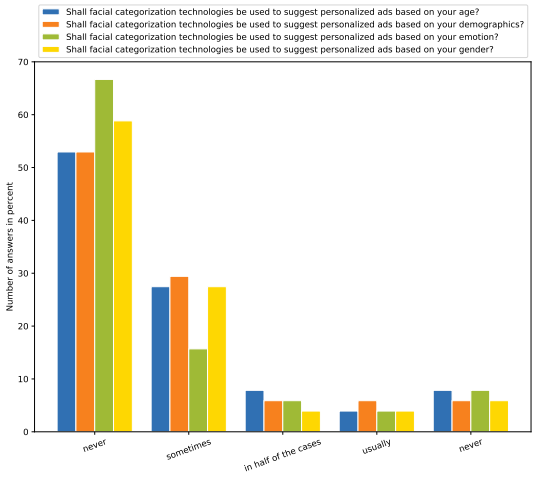

Figure 2: Shall facial categorization technologies be used to suggest personalized ads based on your age, demographics, emotion or gender?

6.4 Feedback on Facial Classification Technologies

The majority of survey participants answered the free text question, what they think about FCT, in detail. Many of them came up with concerns (regarding i.e. monetization, ethics in general, privacy concerns or surveillance in detail). Explicitly it was stated that the technology should be regulated by law. Ethically criticized were the described use cases of surveillance, advertising and hiring. The manipulative potential of the technology was pointed out multiple times as well. The linkage of data retrieved via FCT with other data sources shall not happen and the persons must agree to being analyzed. More than 10% of the participants stated that they did not use their camera, there might have been more who looked at the demo at their seatmates. Additionally criticized was the false classification which the demo presented in some cases (although we did not manipulate any results of Deepface) and calls for improvements of the technology in general came up. On the other hand a small minority appreciated the usage in law enforcement (focusing on facial identification). Quite some appreciate the technology in general but mostly in ethically reasonable contexts mostly with the above listed limitations. Five out of 51 participants entered no meaningful answer at all, four only wrote that they did not use their cameras, additionally two only stated they were neutral.

6.5 Evaluation

One important question regarded whether the participants understood FCT by having a look at our web application. Since most users have not been familiar with FCT, we asked the question, whether they understood FCT in the final question set. It can be seen that we accomplished our goal of providing an introduction into FCT to quite some participants, as depicted in Figure 3.

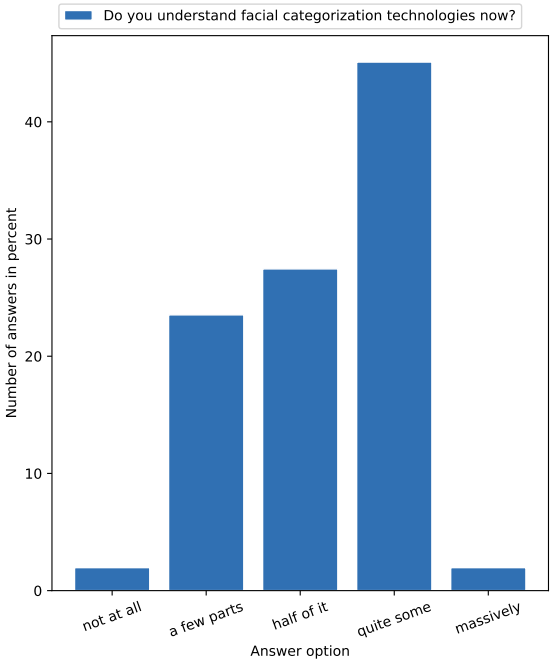

Figure 3: Do you understand facial categorization technologies now?

7 FUTURE WORK

There are several directions in which the web app could be improved:

- Adding additional features: One of the features that is currently missing is the option to upload a photo from the machine. At least 10% of the participants of the survey were not willing to use their camera and were thus excluded from using the demonstration.
- Multi-platform testing and improving reach: To widen the range of people the web app can reach and inform about FRT, the web app should be tested on different devices with different browsers and operating systems. Additionally, a mobile version would reach especially older persons and open the possibility of testing it on the go.
- Enhancing privacy: As facial classification becomes more prevalent, there will be a need to ensure that user privacy is protected. This could involve developing techniques for anonymization of facial data, or designing user interfaces that clearly explain to users how their data is being used. The user has to be informed about the storage and storage length of the data, how to request deletion of their data and further points regulated in the GDPR.

8 GROUP REFLECTION

As a group, we have spent the past weeks investigating various FCT applications that are currently available. Through our research and

analysis, we have gained a deeper understanding of the capabilities and limitations of these technologies.

One of the key strengths of FCT is their ability to quickly and in many cases accurately analyze and classify facial features. Moreover, facial classification can be used in a very positive way that benefits persons with visual impairments, as shown in Microsoft's Seeing AI [2]. FRT in the sense of facial identification can be used security-wise in order to ensure controlled access, since accurate identification of individuals is critical and can reliably be accomplished.

However, we have also recognized the potential limitations and biases of these technologies. In some cases, facial classification algorithms may be less accurate for certain demographic groups, leading to potential inequities in life for the underrepresented groups. These biases must be carefully considered and addressed in the design and implementation of these technologies. The application of FCT shall be limited, regulated by law and users have to consent to be analyzed.

In the context of advertisements, we believe that FCT has the potential to influence and shape people's values and preferences both in a positive and negative way, as it relies on superficial labels such as age, gender, and emotions to define what a person wants. It could motivate people to take up either a good or a bad habit by proposing the same ads repeatedly. We hope that through our demo page on our website, users will become more aware of the potential dangers of using FCT in advertising and be more mindful of its use in the future.

Overall, our group considered this exploration of FCT to be a valuable and informative experience. We have gained a deeper understanding of the potential uses and challenges of these technologies, and we will continue to carefully consider these issues as we move forward.

9 CONCLUSION

In this paper, we have explored various applications of FCT, including their use in FaceMe. As we did not have access to this tool, we decided to replicate it using DeepFace, which allowed us to gain a deeper understanding of the potential benefits and ethical concerns surrounding these technologies. We have found that while they can offer numerous benefits for various industries, they also raise important ethical issues related to biases and privacy that must be addressed. To gather further insights into these issues, we conducted a survey in our web application to gather user perspectives on the technology. We presented the results and pointed out how users perceive these technologies. Overall our research outlines the capabilities and limitations of FCT and demonstrates as well as explains some of these in a web application.

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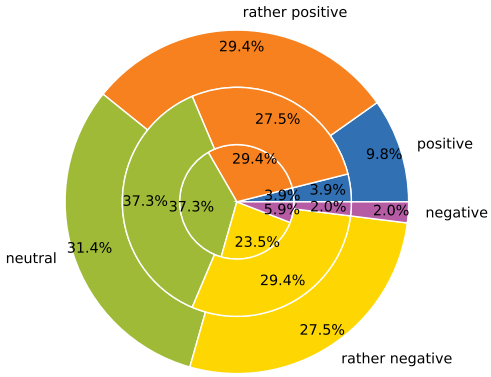
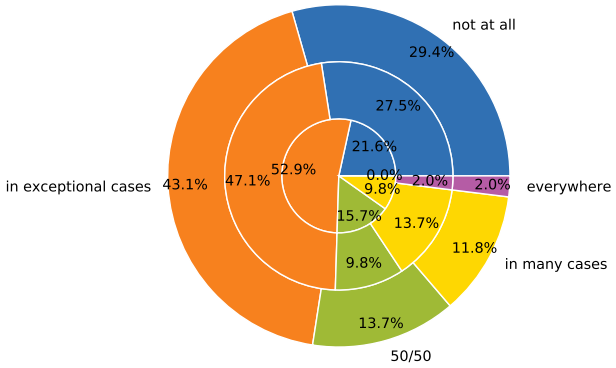
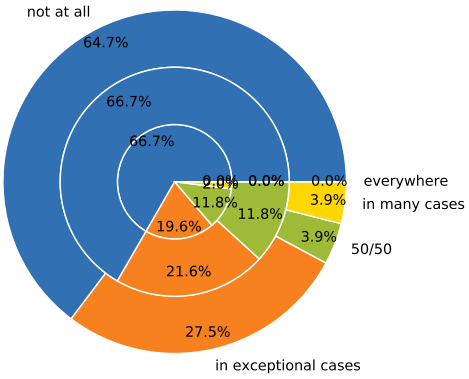


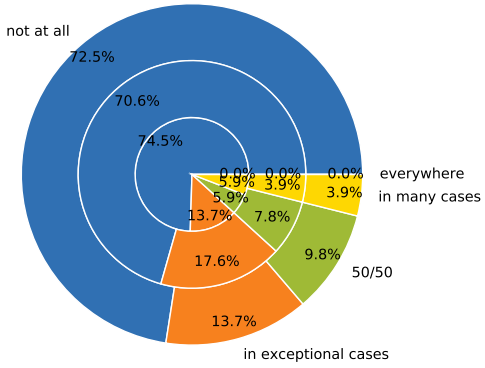
(a) How do you perceive facial categorization technologies in general?



(b) Do you think facial categorization technologies should be used in public surveillance

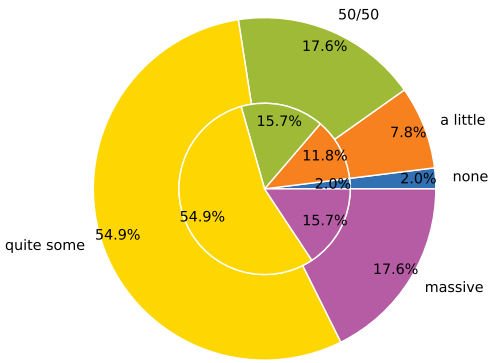


(c) Do you think facial categorization technologies should be used in advertisement

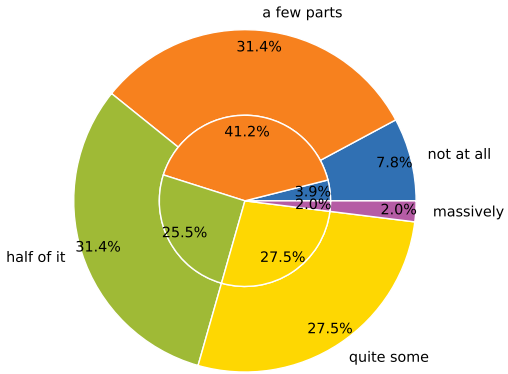


(d) Do you think facial categorization technologies should be used in hiring process

Figure 4: Charts presenting repetitive questions. The innermost pie represents answers of question set 1, the middle one of question set 2 and the outermost of question set 3.



(a) How much influence do you think advertisements have in general?



(b) How much do you think advertisements influence you?

Figure 5: Charts presenting repetitive questions. The innermost pie represents answers of question set 2 and the outermost of question set 3.