Mphasis
The Next Applied

Facial AI in Insurance for Underwriting and Claims

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1.
Introduction

Facial recognition is a technology used to match a human face from a digital image/video frame against a database of faces. As the process involves facial image acquisition followed by extracting and measuring physiological features, it is considered as biometrics. Just as fingerprints, every individual has a unique facial feature or *Faceprint.* The technology can be used in insurance industry to resolve various issues involving underwriting (UW) and claims. The selfie analysis technique along with dynamic questioning can be used to estimate age, sex, BMI and lifestyle habits. This helps to generate personalized policy quote within minutes. Facial AI is also being used for claim processing and detecting fraudulent claims. Using advanced deep learning models, the system can analyze the claimant's responses and micro-expressions/reactions to a set of real-time questions and predict whether the claim is genuine or if any further investigation is needed.

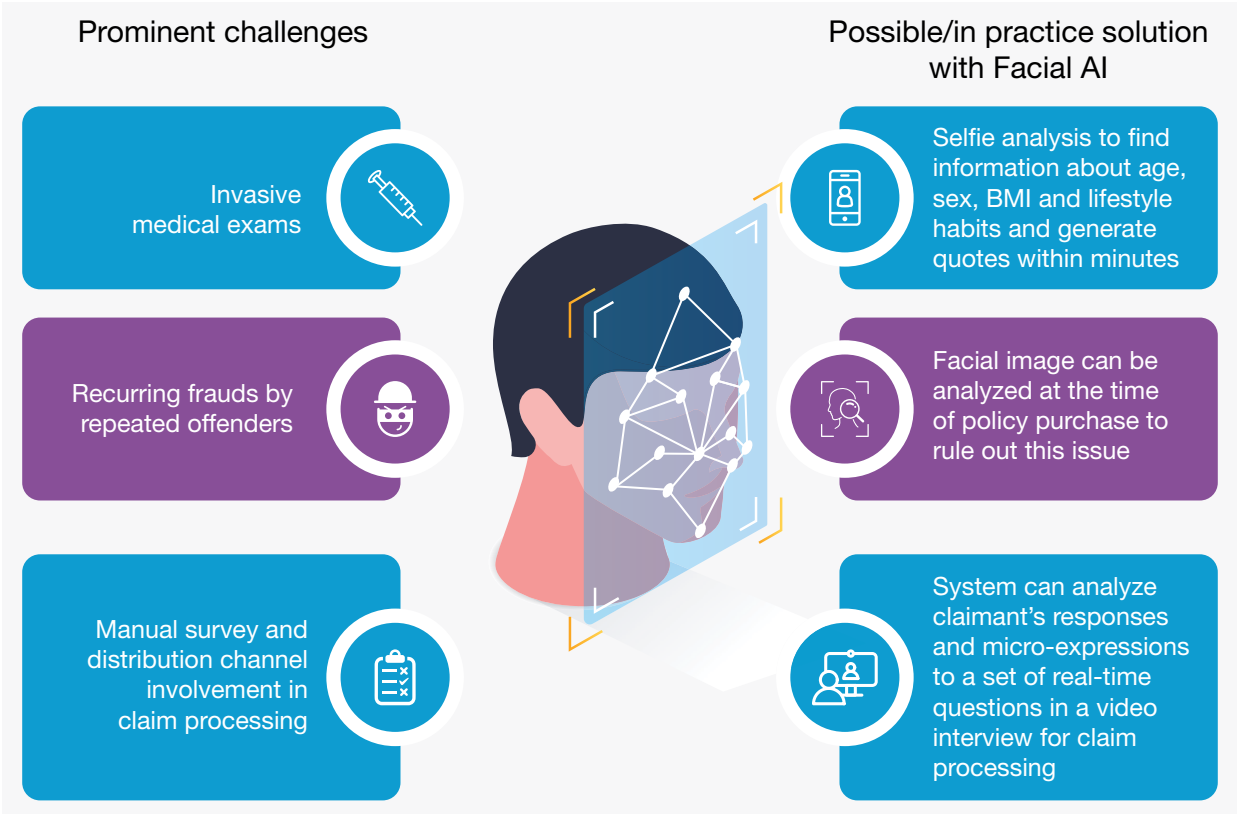

Fig. 1 - UW and claim processing issues and their solutions using Facial AI

The Facial AI technique used as solution for above problems involves training a neural network model on data consisting of face images of different individuals with BMI labels. A neural network model can be trained on age-based face images with class labels as predefined age ranges and also for predicting whether the test face is of an offender or not.

Apart from the various applications, facial recognition models are less accurate compared to other biometrics. Also, there have been technical issues in detecting the gender of different races of people throughout the world. Issues of data leaks and privacy laws of different countries are hindrances in smooth application of Facial AI.

Merger of Facial AI technology with data collected from wearables can provide excellent insights for underwriting. As both face analyzer and wearables like Fitbit can estimate body fat and BMI, they can complement each other by providing supporting evidence, hence paving the way for a more accurate UW. This further lays the foundation for continuous underwriting. If a customer who is also a BP patient is doing workouts regularly (as tracked by face analyzer and wearables), she/he may not need to pay the extra premium, or their premium can be reduced based on the healthy lifestyle opted. Facial AI reinforced with other biometrics like fingerprints or OTP verification can mitigate the vulnerability of the security system.

2.

Role of Facial AI in Insurance Underwriting and Claims

Insurance companies face many issues related to **underwriting and claim processing** with respect to the time and tedious processes involved with old techniques. Consequently, they are aiming to make a shift towards AI solutions in an attempt to reduce human involvement and using the technology to ease the working processes, without compromising on the quality of customer service and accuracy.

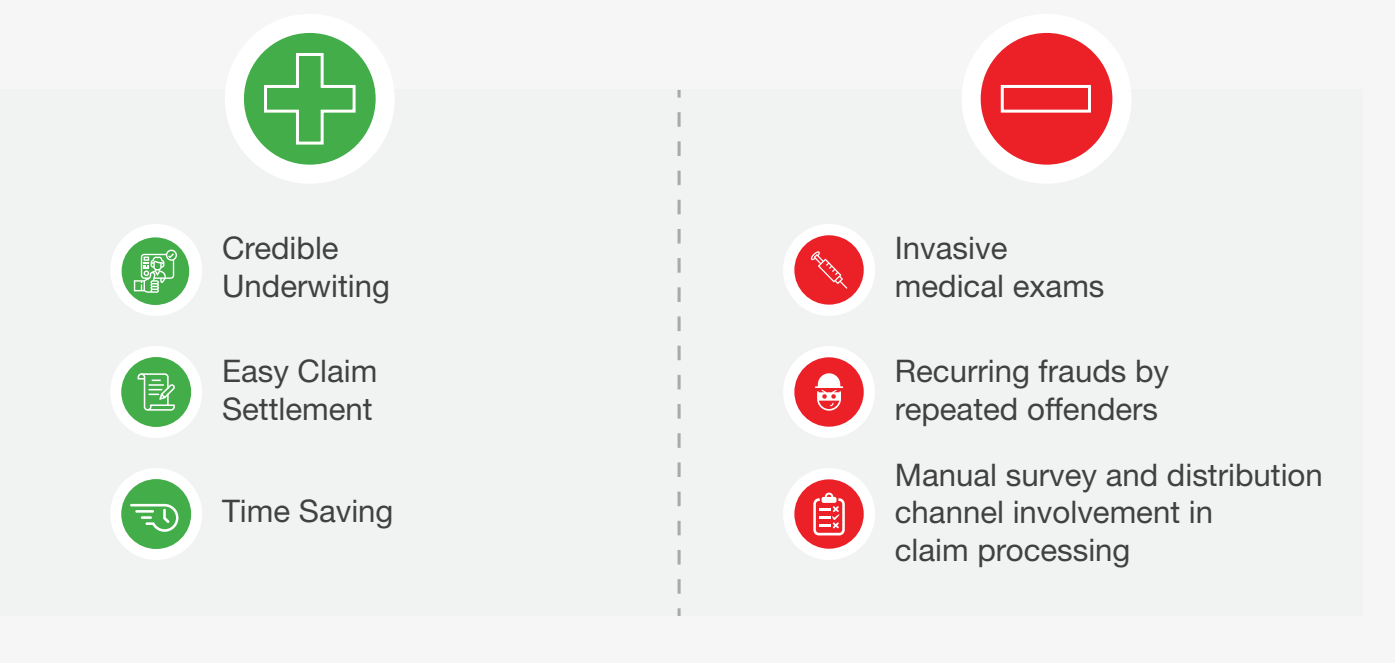

Fig. 2 - Benefits of Facial AI and issues related to current practices of UW and claims

Facial recognition technology has two main components for building an effective estimator: facial feature extraction and estimator learning.[1] First, the feature is extracted from an input image and

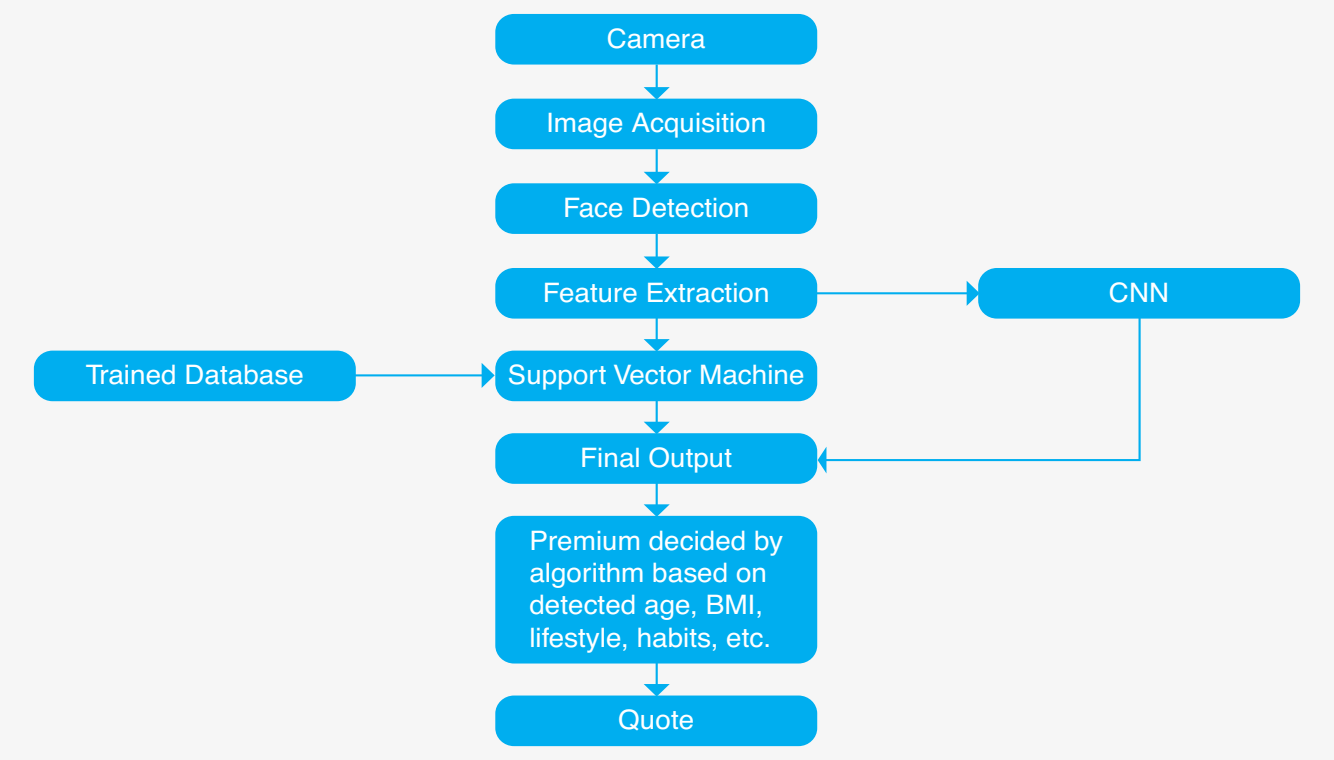

Fig. 3 - Facial AI based policy purchase

then compared with database images of different age groups with the specified weight.

There are various examples where insurance companies are trying to implement Facial AI. For example, **Lapetus Solutions,** a US-based startup, helps mobile-enabled insurance customers get **the online quote, application and purchase services using facial recognition.** The face analyzers used for the purpose can provide information regarding gender, age, BMI estimates, body fat, blood pressure and lifestyle like smoking habit by analyzing a simple selfie.[2] It makes the **underwriting process quicker and easier.** Facial recognition, along with cloud computing, is used to provide **tailored policy** for everyone within 10 minutes. Applicants must upload their selfie and answer 4-15 simple questions related to life events and biodemographic information. The system instantly processes this information to deliver the individual's life span without an invasive medical exam. Hence, a new term **"no touch underwriting"** has evolved.

Fraudulent claims have always been an area of concern for insurance companies. According to a research done by the Association of British Insurers in 2019, 125,000 fraudulent claims worth £1.3 billion were detected in UK alone irrespective of the fact that it invests £200 million to identify fraudsters. [3] Facial AI has the answer for this daunting issue. Facial AI can detect emotions and suspicious behavior with its newly developed deep learning models. Claim processing can be done by interviewing the claimant over smartphone and **analyzing their micro-expressions, pupil dilation, eye movements, speech patterns and tone of voice.** Using advanced deep learning models, the system would analyze their responses and micro-expressions/reactions to a set of real-time questions. This will help insurers to predict whether the claim is genuine or if any further investigation is needed. This is also termed as **"new polygraph test for insurers".** The technology can also be used in underwriting to check whether a prospective customer is providing true information or not while purchasing a policy. The suite of solutions also includes **liveness detection,** which **detects attempts to fool facial recognition software.** Chinese insurer, **Ping An Insurance,** has implemented the technique and used Facial AI to verify its staff and customers' identity.

Let us look at a few Insurance scenarios in detail.

Scenario	Policy Issue Steps	Without Facial AI		With Facial AI	
		Process	Total Time	Process	Total time
Life-insurance policy purchase	Rate quotes	Online/Manual-Mailing	5-10 mins	**Facial analytics, biodemographic information and dynamic questioning** is used to find gender, age, BMI and other relevant information for engagement, approval and product development. **"No touch underwriting".**	15 mins
	Form review	Manual	24-72 hours		
	Medical exam scheduling/ conduction	Manual - Checking height, weight, habits, blood sample, urine samples and multiple questionnaire	1 week		
	Underwriting	Manual - Checking pre-existing/ previous disease and analyzing current risks based on medical exam	Up to 4 weeks		
	Final review and policy issue	Determining the final risk based on age, profession and overall health	1 week		
		Approximate total time in (mins)	60,480	Approximate total time in (mins)	15

Fig. 4 - Life insurance policy issue can be 4,000 times faster using Facial AI (Source: Mphasis)

Scenario	Without Facial AI		With Facial AI	
	Process	Time	Process	Time
Life-insurance claim	1. Initiating the claim -online/phone/in writing 2. Analysis of contestability clause/ death certificate/police & medical report 3. Payout	At least 30 days	Claims can be processed just by interviewing the claimant over smart phone and **monitoring/analyzing the micro-expressions, pupil dilation, eye movement, gaze, speech patterns, tone of voice & other human emotions.** Using this, claims can be processed almost in real-time.	15 mins
	Approximate total time in (mins)	43,200	Approximate total time in (mins)	15

Fig. 5 - Life-insurance claim processing can be 3000 times faster using Facial AI (Source: Mphasis)

3.

Implementing Facial AI in Insurance

For the insurance domain, artificial intelligence can help in several areas such as fraud detection, reducing the overall clearance process, improving customer experience by automating most tasks, etc. Machine learning and deep learning are the methods employed in artificial intelligence. Each method performs excellently on different variety of data. For example, deep learning is best suited to solve problems involving visual data. Data is an important factor for the success of deep learning models, and this poses a new question of **"How to collect data?"**. The conventional ways include hiring people to collect data and annotate it according to the problem statement. However, given the amount of data needed for deep learning tasks, this method is impractical in the current scenario. The other ways of collecting data are using the Internet of Things (IOT), scrapping from the web where the data is available, purchasing data from third-party sources or to use pre-trained deep learning networks.

Generally, machine learning model performance becomes flat once certain amount of data is fed to the model, whereas in case of deep learning model, more the data, better the results will be. Real data is found to be generally biased. Training deep learning models on biased data may lead to biased models which may not understand the features of a class with less data. So, to resolve this problem, image data augmentation is performed which involves creating transformed versions of images. In image data augmentation, generally the value of few pixels in the image is changed and then image is rotated by few degrees. Deep learning library Keras has ImageDataGenerator class which supports image data augmentation.

Features are useful patterns present in the data which help in identifying the object. For example, the features for a human face include the edges of the face, eyelines, edges of the mouth, etc.

For the insurance domain, we are more concerned about visual data – be it facial data, scanned documents, etc. In this paper, we will discuss about facial data and how it can be used to improve the overall performance of the insurance domain.

Once the facial data is collected, the primary task is to identify the facial object present in the data - known as object detection problem. There are open-source libraries such as OpenCV and pre-trained models like ImageNet to identify the object, i.e., faces present in the images and once the region of interest is identified, image processing techniques can be applied. To make images understandable by machines, images are converted into pixels and the image processing applies mathematical functions to these pixel values to be consumed by deep learning model easily. The standard image processing techniques include converting the colored images into grayscale, making the size of the image standard across all the images, normalizing the pixel values, etc. After the image is processed, the next task is to extract the features. The significant advantage that deep learning models have over machine learning models while dealing with visual data is automatically extracting features. Deep learning models such as Convolutional Neural Networks (CNN) perform exceptionally well in identifying the visual data features.

Face Detection and Face Recognition

Face detection involves finding the coordinates of the faces present in an image. The trained computer vision models predict the faces and enclose them in rectangles. Face recognition refers to identifying faces on which face recognition model is already trained. So, the data used for training face recognition model consists of images of people of different ages, with and without facial hair and accessories. Model training involves detecting the faces in the input images and then converting them into the multi-dimensional array which can be fed to the convolutional neural network. The convolutional neural network finds the local and global patterns present in the images and learns these features with the identification of the person.

Automatic face recognition is a 4-step process:

1. Face detection

2. Face alignment

3. Feature extraction

4. Face recognition

Estimating BMI from Face Images

Using a machine learning model to predict BMI can benefit insurance companies in diagnosis. Before model training, the preprocessing of images is required in which image normalizing (cropping to the subject's face) happens. To detect the subject's face in each image, the Python library *dlib* can be used. Deep learning models perform better if trained on large datasets and collecting huge amount of real data. To increase the size of dataset for improved model performance, data augmentation is performed by changing the original images to create extra augmented images. Data augmentation does not alter the distribution of labels in the augmented dataset from the original dataset. In real situations, the original data is usually unbalanced, and the models trained on unbalanced data will be biased which will predict only the most-frequent class(es). To balance the dataset, selective data augmentation can be applied. It refers to oversampling the less frequent class samples, to adjust their amount in comparison with frequent class(es) samples. There are many python packages available for performing re-sampling/oversampling techniques which are compatible with scikit-learn. The ResNet (residual network) architectures are considered as good models for recognizing facial features. In a few research studies, it is advised to use transfer learning for training the model on images so that we can leverage the weights trained from pre-trained models (easily available for research and other purposes) on face images.

A neural network model can be trained on the data of face images of different individuals with BMI labels.

Estimating Gender from Face Images

A neural network trained on gender-based face images database with class labels as: male, female and others, will provide probabilities of classes for the test images and the dominant class having largest value of probability would be considered as predicted class. These neural networks store the information of influence of gender on facial components.

Estimating Age from Face Images

A neural network trained on age-based face images database with class labels as predefined age ranges will provide probabilities of classes for the test images and the dominant class having

largest value of probability would be considered as predicted class. These neural networks store the information of influence of age on facial components. Some face image databases are available for research and other purposes such as FG-NET, MORPH Album2, PCSO, etc.

Identifying Repeated Offenders Using Face Recognition

The problem of identifying repeated offenders can be solved in two ways: **binary classification** and **multiclass classification.** In binary classification, the training data is labelled with only two classes: repeated offender or not. A CNN model trained on this data can be used for predicting whether the test face image is of an offender or not. In multiclass classification, the training data is labelled with repeated offender identity (name/ID of the repeated offender). A CNN model trained on this data can be used for predicting whether the test face image matches with any offender. In multiclass classification, the trained model predicts probabilities of test image matching with the training database. A threshold for probability can be set and accordingly, the identity of the person can be derived. If no probability value crosses the threshold, then the person is not a repeated offender.

4.
Conclusion

In this paper, we discussed the various issues faced by insurance companies related to UW and claims and their in-practice & potential solutions using Facial AI. Accuracy of facial recognition model has increased, but its vulnerabilities still exist. Facial recognition can be merged with other biometrics like fingerprints or OTP verification to reinforce the security. Another challenge for implementing AI in insurance is the lack of training data to improve the model accuracy and decision making. Any error may result in financial as well as reputational loss of customer or company. Apart from these, there are regulatory and privacy risks involved. Customers should be aware about how their data is being collected, how the insurers are using them, what algorithms are being used to process it, etc.
For instance, if the insurer tracks the location of a customer, it should only be used to provide personalized products and not otherwise. There should be ample security measures to check data leaks. The model should also be robust enough to withstand any cyber-attack by fraudsters. Irrespective of various challenges, Facial AI is poised to transform the insurance industry in the coming decades.

Facial AI and its applications are being implemented in insurance industry but its future depends on how researchers will solve the existing problems such as accuracy, gender and racial biases, privacy concerns, etc.

Reference

[1] http://iosrjournals.org/iosr-jece/papers/Vol.%2012%20Issue%204/Version-5/C1204051116.pdf

[2] https://www.lapetussolutions.com/

[3] https://www.wesee.com/uncategorized/how-facial-recognition-could-save-insurance-companies-billions/

About Mphasis

Mphasis (BSE: 526299; NSE: MPHASIS) applies next-generation technology to help enterprises transform businesses globally. Customer centricity is foundational to Mphasis and is reflected in the Mphasis' Front2Back™ Transformation approach. Front2Back™ uses the exponential power of cloud and cognitive to provide hyper-personalized ($C = X2C^{2}_{TM} = 1$) digital experience to clients and their end customers. Mphasis' Service Transformation approach helps 'shrink the core' through the application of digital technologies across legacy environments within an enterprise, enabling businesses to stay ahead in a changing world. Mphasis' core reference architectures and tools, speed and innovation with domain expertise and specialization are key to building strong relationships with marquee clients. To know more, please visit www.mphasis.com

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