Application of Artificial Intelligence in Claim Management and Fire Surveying in the context of Bangladesh▪

Nujhat Nahar[*]
Intisar Tahmid Naheen[**]
Sayed Jobaer Hasan[***]

Abstract

With the advancement of technology, the whole insurance business is getting more and more automated day by day. In Bangladesh, the insurance industry is getting involved as technology as well. Even though the concept of Artificial intelligence (AI) is quite new in the insurance business, it is having a massive stride in other financial corporations. Some classes of AI like Natural Language Processing (NLP), Computer Vision (CV) are getting used in different financial organizations. Claim management and surveyance are two of the most important parts of the insurance system. In this paper, we explore the possibility of using AI in these two fields of insurance in the context of Bangladesh. After discussing the initial terminologies, we discuss the steps following which we can utilize AI in claim management and fire surveying. We also discuss the network architecture of AI models in the paper. And finally, we discuss our progress so far in implementing AI in the Bangladesh insurance business.

Keywords: Artificial Intelligence (AI), Insurance, Claim Management, Fire Surveying, Artificial Neural Network (ANN), Convolutional Neural Network (CNN), Neural Network etc.

Introduction

Insurance is one of the basic contracts made by individuals, partnerships, and other enterprises for money related assurance or provision against potential and unforeseen misfortunes. It is one of the most diligently and efficiently managed enterprises in the world. With the adoption of the latest technological advancements by various organizations, insurance companies are getting more automated. Hence the need to install the latest equipment and software and at the same time to acquire and constantly upgrade computer aptitude is a very fundamental need. One of the most important functions of the insurance business is a mutually beneficial claim management system. Artificial Intelligence (AI) is currently a much-talked-about subject, cutting edge technology,

** DSVP, Technology Department, Green Delta Insurance Co. Ltd., Bangladesh. Email:nujhat.nahar@green-delta.com*
*** IT Trainee Officer, Green Delta Insurance Co. Ltd., Bangladesh. Email : intisarnaheen@gmail.com*
**** IT Trainee Officer, Green Delta Insurance Co. Ltd., Bangladesh. Email : sifat.jobaer@gmail.com*
▪ *This paper was submitted as a Technical Paper at the NIA-SWISS Re International Seminar, 2020, Mumbai.*

and an in modern science. Currently, AI is being applied in different insurance business segments and these are making breakthroughs in achieving the desired objectives. This paper, therefore, examines the potential application of AI in Insurance Claim Management and categorizing its uses. Insurers now have the option of applying and achieving better claims management systems. They can utilize AI technology in the following ways:

- Pre-assess claims while automating the damage evaluation process.
- Automate fraud-claims detection through data analytics.
- Predict patterns of claim volume.
- Augment loss analysis.

Even though these technologies are being used in different countries like the USA and India, Bangladesh is yet to adopt the AI technology. Hence the Bangladesh insurance industry is in the initial phase of creating a methodology to adopt AI and examining its future prospect.

The basic idea and background of insurance companies that use AI for claim management and survey are discussed in the first part. In the second part of the paper, the methodology of the AI model that can be deployed for claim management is discussed at length. The model consists of neural networks, like Artificial Neural Network (ANN), Convolutional Neural Network (CNN) which are also discussed in detail.

2. Background and Review

Let us first examine terms likeAI in claim management and fire surveying.

2.1 Artificial Intelligence

In simple words, Artificial Intelligence (AI) is a simulation of the human brain. Technically stated, artificial intelligence is a cognitive system of acquiring and performing tasks like human brain functions[1]. Imagine the scenario: one of the very first intellectual functions that a normal human being do is to make decisions. We may ask 'what sort of decisions does an individual take?' raised. It totally depends on how one is trained to do it. That is to say, AI is a system that needs to be continuously upgraded and equipped to perform tasks that individuals are naturally endowed with to perform.

AI is made to function on the basis and use of various coded (computer) languages. It performs in three segments or combines three skills. First is 'Learning", that is, it learns from the data that is programmed to do. It assembles the given data and triggers the desired action. Utilizing the given algorithms, it is triggered to take the desired decision (action) step-by-step (systematically). The second function is 'Reasoning'. Again, from the already in-built algorithms, AI selects the best possible option/s and executes the action/s. The third is 'Self-correction'. In this segment, AI is completely different from any other programming systems. This function ensures accuracy and strengthens the AI's efficiency.

2.2 Claim Management

The resolving of the insurer's claim and ensuring the insured's right to possession of the insured product by the insurer is called claim management. The insured can be an individual or a firm[1]. Before delving into claim management per se, it is desirable to understand what is a claim and how it occurs. When a particular insured product has faced damages (specified in the policy) the insurance company (insurer) has the obligation and the responsibility to provide the remedy for the loss/es incurred[2].

When a claim is raised there are two details the insurance company must check: (a) Has there been an actual loss or not; (b) Estimate the amount or the value of losses. Presuming that the insured party can provide all the necessary proof thereof, the settler (insurer) adjusts the claims between both parties. Before settling the claim, the settler has to keep two aspects in mind: is the claimant being (i) underpaid or (ii) is s/he overpaid. As the insurance company is stipulated to ensure that the policyholder must regain the previous positions[3]. In either of the conclusions the settler has arrived at, the dead weight of loss would be significant.

So managing a claim has the target to arrive at a point where everyone, from settler to claimer reaches a win-win situation. But to reach that desired point, the settler has to diligently go through every minute detail of the claim. This implies more and more detailing ability which depends on the experience of the particular individual who gains that acumen through analyses of manifold and varied claim cases. That would help lead the settler to arrive at an appropriate and accurate claim-settlement decision. So we may conclude here by stating that claim management is to make Pare to point certain.

2.3 Fire Surveying

The amount of crucially it carries that has to be perpetuated by the same level of scrutiny. For this very particular reason, scrutiny and survey of the insured's property are of paramount importance.

For this very reason, experienced surveyors are assigned by the insurance companies themselves. This is to say that when a client comes to buy a fire insurance product, the insurance company assigns a surveyor to gauge the quantum of risk it is taking. This evaluation undertakes two types of analyses. One is the situational analysis and the other is occupational analysis. These two analyses mainly take into account the quality of construction, the types of safety measures/equipment installed, what types of products are stored therein and other engineering aspects of the property to be insured. Scrutiny of all these aspects falls under the purview of the surveyor who classifies the details into different categories, which are infact already predetermined by the insurance company. The surveyor has only to pigeon-hole the details (observations) of the construction into the fixed parameters.

Right now there are only a few insurance companies in the world that utilize AI technology for claim management settlement. Some of them are discussed below.

2.4 Clear Cover

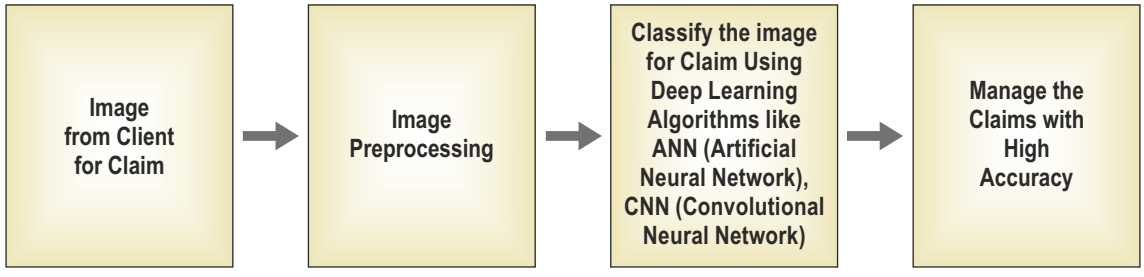
Clear Cover[4] uses artificial intelligence to ensure quick claim processing. After filling out a basic questionnaire, Clear Cover users will receive AI-generated quotes, and, the clients can choose the one that best fits their needs. When the insured happens to be involved in an accident, he need only to snap a few pictures and fill out a short form and email them to the insurer. The company takes it from there thus saving precious time. Human intervention is significantly costly and time-consuming. As the categories are already pre-fixed, we believe that AI can do the rest in a shorter period of time. By giving proper guidance, AI can also be well pre-determined (trained) enough to categorize any property and also undertake the value assessment more accurately within a short period of time.

The same can be stated for the claim portion as well. Whenever a policyholder submits a claim report-cum-request, the insurance company sends its own surveyor to check and estimate the amount of loss/es. Thus an AI intervention can be applicable here as well if the first objective of insurance - "Utmost Good Faith" - is upheld. Apart from Clear Cover, Flyreel, Galaxy AI companies use AI for claim management and underwriting.

3. Methodology

For applying computer vision in the whole claim management and fire surveying process we follow the procedure illustrated in Figure 1 below:

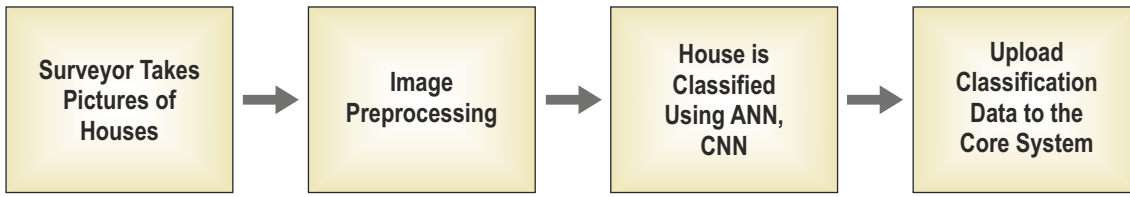
Figure 1: Steps of Applying AI in Claim Management



In the first place images from the clients who want to claim for the damage are collected. Initially, it can be applied mainly to motor insurance. After getting the image it will be preprocessed using annotation tools like CVAT. Then the model is ready for a deep learning model like CNN. Thereafter, the high accuracy/resolution images are used for claim management.

Similarly, the steps for categorizing the houses for surveying fire damage have been detailed as illustrated in Figure 2.

Figure 2: Steps of Applying AI for Categorizing Houses in Fire Insurance



The Algorithm Deployed

3.1 Artificial Neural Network

An ANN is basically a processing system. This process is inspired by the human biological nervous system. One of the examples of this system is based on how the brain processes information. This information processing is composed of a large number of highly interconnected processing elements (neurons). These neurons interact with each other to solve specific problems.[4]

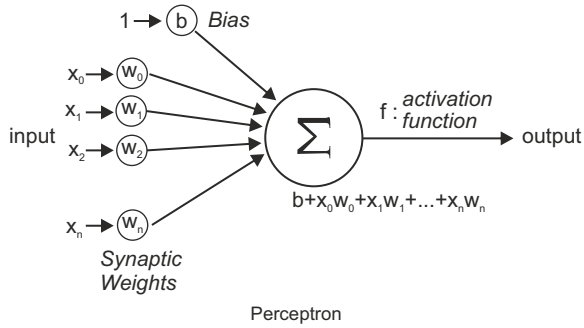
3.2 Computational Model of Neurons

Back in the 1960s neural networks were termed as perceptron by McCulloch-Pitts. A single layer unit was proposed[5] as a computational model for an artificial neuron. Later, multilayer neural networks were evolved which are termed as Artificial Neural Networks. The single-layer model can be explained by the following equation:

$$y = f\left(\sum_{i=1}^{n} x_i w_i + b\right) \quad .....(1)$$

In equation (1), y is the output of the neural network. For a single observation, x is the input function; w is the weight. The strength of a particular node is shown by weight. This equation (4) is depicted in Figure 3.

Figure 3: Example of an ANN (a perceptron)



In Figure 3 and Equation 1, f(.) is the activation function and b is the bias value. Using the bias value, the activation function can be shifted up and down.

3.3 Activation Function

The activation function is used in order to transform the activation level of a unit (neuron) into an output signal[6]. There are mainly two types of activation functions[7]:

1. Linear Activation Function,
2. Non-linear Activation Function

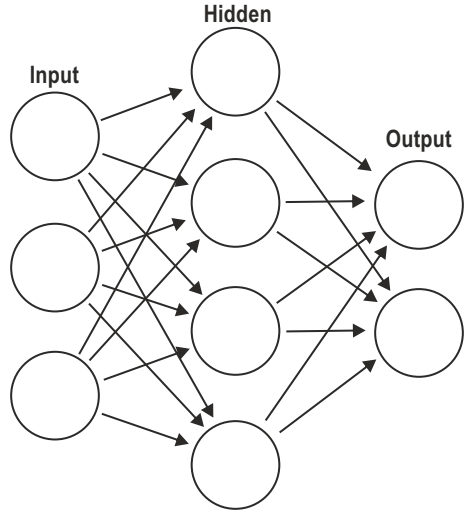
The output of linear activation functions does not stay confined between any range. That is why these are not very helpful.

Different kinds of non-linear activation functions are used in neural networks. Among them, Sigmoid Function, Hyperbolic Tangent Function (Tanh), Soft-max Function, Rectified Linear Unit (ReLU) Function, etc., are more widely used for different cases. They are used according to the need of the applications. A comparative analysis of these networks is now discussed.

3.4. How Neural Networks Work

Up to now, we have discussed only a single layer ANN. Now we are going to discuss multi-layer neural networks. In multi-layer ANN, in between the input layer and the output layer, there are a number of hidden layers. The job of a hidden layer is to transform the inputs into something that the output layer can use. The number of hidden layers can be adjusted according to the need of the application. All these layers are just a set of neurons.

Figure 4: Example of an ANN (a Multilayer ANN)



A multi-layer ANN is depicted in Figure 4.

Now after passing through this multi-layer neural network, a response of the input is found at the output layer. After that, a difference between the actual value from the input layer and the predicted value in the output layer has been calculated. This difference or error value is termed as a Cost Function. This is computed and returned through the system. One of the most commonly used cost function is termed as Mean Squared Error (MSE). MSE simply squares the difference between the output of every network and the true label and then finds the mean of this value. If C is an MSE cost function, the C can be termed by the following equation:

$$C(y, o) = \frac{1}{N}\left(\sum_{i=1}^{n} (yi - oi)^2\right) \quad \cdot \quad (2)$$

In equation (2) above, y is the vector of the true label and o is the vector of network prediction. Now in a neural network, the idea is to minimize the cost function as much as possible in each layer. In order to do that the weights are updated. This procedure is termed as Back-propagation. This procedure is applied continuously through the layers of a neural network until the error value of the neural network can be kept at a minimum.

There are two ways to adjust the weights:

(a) Brute-force method

(b) Batch-Gradient Descent

The brute-force method is more suited to the single-layer perceptron. So, for the multi-layer neural net, mainly a Batch-Gradient Descent is used for back-propagation.

An ANN is divided mainly into two network architectures:

1. Convolutional Neural Network (CNN)
2. Recurrent Neural Network (RNN)

For our application, we only need to know about CNN.

3.5 Convolutional Neural Network

Convolutional Neural Networks (CNNs) were first introduced by Le Cun et al[7] and is also a biologically inspired neural network. These show exceptional performance in different kinds of machine learning tasks and deep learning applications[8]. The architecture of CNN is illustrated in Figure 5.

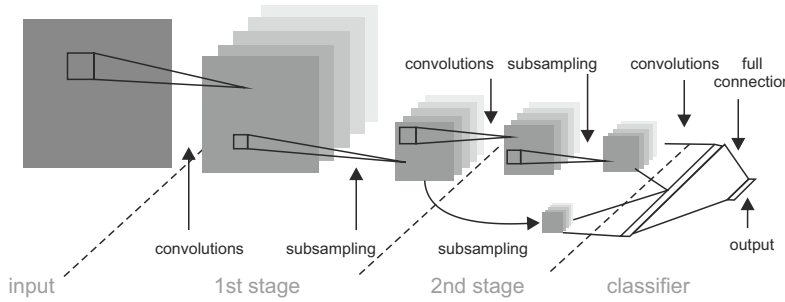


Figure 5: A 2-stage Convolutional Neural Network architecture [9]

Repeatedly stacked feature layers compose the architecture of a CNN. In each stage, there is a convolution module, followed by a pooling/subsampling module and a normalization module.

Convolution Layer

In a CNN, convolution operation occurs in each layer between the layer input of the previous layer and the weight of that layer. So starting x, each subsequent layer x is computed as:

$$x1\ (u, ki) = f\left(\sum_{i=1}^{n} xi - 1\ (., k) \circledast wi, ki\ (., k)\ (u) + b\right) \quad \ldots (3)$$

In Equation (3), f is again the activation function and w is the weight, and * is the discrete convolution operator.

The optimization problem defined by a convolutional neural network is highly non-convex. So, typically, the weights are learned by stochastic gradient descent, using the back-propagation algorithm to compute gradients.

The Pooling Layer

The Pooling layer is responsible for reducing the spatial size of the Convolved Feature. This is to decrease the computational power required to process the data through dimensionality reduction. Furthermore, it is useful for extracting dominant features that are rotational and positional invariant, thus maintaining the process of effectively training of the model.

There are two types of Poolings: Max Pooling and Average Pooling. The Max Pooling returns the maximum value from the portion of the image covered by the Kernel. On the other hand, the Average Pooling returns the average of all the values from the portion of the image covered by the Kernel.

Max Pooling also performs as a Noise Suppressant. It discards the noisy activations altogether and also performs de-noising along with dimensionality reduction. On the other

hand, Average Pooling simply performs dimensionality reduction as a noise suppressing mechanism. Hence, we can say that Max Pooling performs a lot better than Average Pooling.

Bangladesh's insurance sector is right now at the data collection stage. We are hoping to collect around 50,000 images of different house/building categories for surveying. The model for the pertinent data gives very good accuracy.

4. Conclusion and Future Work

In this paper, we discussed the several ways of using automation that can be applied in profitable and beneficial ways for the development of the insurance industry. We also investigated how deep learning and computer vision are being applied for insurance applications in the context of the Bangladesh insurance sector and how it can best be used to help automate and analyze a large amount of data for claim management processing and fire surveying. In the context of Bangladesh, the potential is immense. We are at the data collection stage. In the second stage, the automated digital industry is expected to take over the insurance business.

References

[1] "Artificial intelligence abstracts", Artificial Intelligence, Vol. 32, No. 3, pp. 414-15, 1987. Available: 10.1016/0004-3702(87)90098-1.

[2] "Claim Management in Bauwesen", Bautechnik, Vol. 76, No. 12, pp. 1139-1139, 1999. Available: 10.1002/bate.199907320.

[3] K. Bu-Bshait and I. Manzanera, (1990) "Claim Management", International Journal of Project Management, Vol. 8, No. 4, pp. 222-28,. Available: 10.1016/0263-7863(90)90030-f.

[4] E. Kesavulu Reddy, (2013), Neural Networks for Intrusion Detection and its Applications with Deep Learning Frameworks, pp. 1–25. Cham: Springer, Vol. 2, pp. 1210–214,

[5] W. S. McCulloch and W. Pitts, (1988) Neurocomputing: Foundations of A Logical Calculus of the Ideas Immanent in Nervous 126. Cham: Springer International Publishing, 2019. Activity, pp. 15–27, Cambridge, MA, USA: MIT Press.

[6] B. Karlik and A. V. Olgac, (2011) Performance Analysis of Various Activation Functions in Generalized map Architectures of Neural Networks..

[7] Y. LeCun, B. E. Boser, J. S. Denker, D. Henderson, R. E. Howard, W. E. Hubbard, and L. D. Jackel, (1989), "Handwritten Digit Recognition with a Back-propagation Network," in NIPS,

[8] I. G. Goodfellow, Y. Bengio, and A. C. Courville, (2015) "Deep Learning", Nature, Vol. 521, pp. 436–44.

[9] P. Sermanet, S. Chintala, and Y. LeCun (2012), "Convolutional Neural Networks Applied to House Numbers Digit Classification", CoRR, Vol. abs/1204.3968,

♦♦♦