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A NOVEL METHODOLOGY FOR SOFTWARE TEAMBUILDING USING ANNS

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Declaration

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: I, *Hemant Kumar Chaudhary* the author of the research paper entitled A NOVEL METHODOLOGY FOR SOFTWARE TEAMBUILDING USING ANNS declare that , I take the responsibility of the content and material of my paper as I myself have written it and also have read the manuscript of my paper carefully. Also, I hereby give my consent to publish my paper in Anvikshiki journal , This research paper is my original work and no part of it or it's similar version is published or has been sent for publication anywhere else. I authorise the Editorial Board of the Journal to modify and edit the manuscript. I also give my consent to the Editor of Anvikshiki Journal to own the copyright of my research paper.

Abstract

We already know the four P's of the project management that are people, problem, process & project. The project manager has to know the properties of the people in order to manage their people wisely. Software teambuilding involves formation of project team from the available human resources depending upon the kind of candidate project & the skill sets of the people. For automating this decision process we present a hypothetical example using incremental Perceptron Supervised Learning Algorithm and another approach using Decision Tree Learning methodology.

An Artificial Neural Network (ANN) is an information-processing paradigm that is inspired by the way biological nervous system, such as the brain, process information. ANNs like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process.

In this paper we present a novel methodology for software teambuilding using ANNs [1]. Decision Tree Learning can also be used on the similar grounds for the learning tasks. We also present software team formation for software project management using Decision Tree Learning approach.

Keywords: DTL, Software Project Management, Teambuilding, Supervised learning, ANN.

1. Introduction

An Artificial Neural Network (ANN) is an information-processing paradigm that is inspired by the way biological nervous system, such as the brain, process information. ANNs like people, learn by example. An ANN [4] is configured for a specific application, such as pattern recognition or data classification, through a learning process [6,7,8].

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We already know the 4 P's of the project management [2,3] that are people, problem, process & project. Project manager has to manage these four things for successful software products. He has to know the properties of the people in order to manage their people wisely. The project manger focuses on problem solving & high product quality. In this paper we propose the application of neural networks for software teambuilding for a specific software project. We propose the use of Fixed Increment perceptron learning algorithm, Supervised-learning mode [1,7] for software teambuilding. Here we take a hypothetical example to demonstrate how neural network helps project managers to select people for a particular software project. We take into consideration the following personal properties for the decision making process.

1) Talent
2) Job Matching
3) Team building
4) Key Personal relations
5) Training

Table 1 shows the learning task represented by the training examples. Here our target attribute is selection, which can be yes or no; determined by the personal properties of the people. These are the candidate fourteen training examples, which are just representative of the many possible combinations of the cases that could emerge up for a particular person. We use these as the training examples for the neural networks during the training phase by assigning appropriate weights to these properties. Subsequently we present the same task of software team formation using decision tree learning.

2. Perceptron Model

The training algorithm of the perceptron is a supervised learning algorithm where weights are adjusted to minimize error whenever the computed output does not match the target output. Fig. 2 illustrates a simple perceptron network.

T A B L E 1 *Fourteen Training Example Set*

Talent	Job Matching	Team Building	Key Personal Relation	Training	Selection
Low	Poor	Weak	Poor	Untrained	No
Low	Poor	Strong	Average	Untrained	No
Medium	Poor	Weak	Good	Untrained	Yes
High	Average	Weak	Good	Untrained	Yes
High	High	Strong	Average	Trained	Yes
High	High	Weak	Average	Trained	No
Medium	High	Strong	Poor	Trained	Yes
Low	Average	Weak	Good	Untrained	No
Low	High	Weak	Good	Trained	Yes
High	Average	Strong	Average	Trained	Yes
Low	Average	Strong	Good	Trained	Yes
Medium	Average	Weak	Good	Untrained	Yes
Medium	Poor	Weak	Average	Trained	Yes
High	Average	Strong	Poor	Untrained	No

A more general multiplayer feed forward perceptron has on intermediary layer.

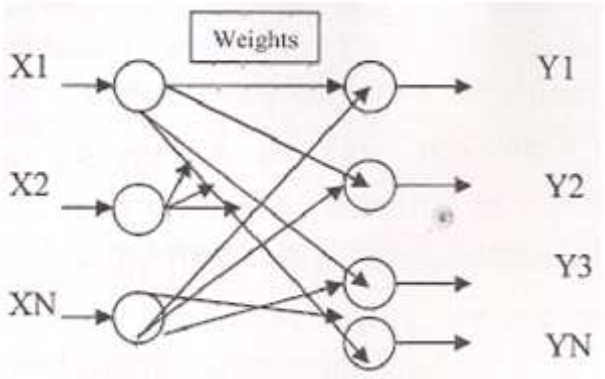

Fig. 1 A Simple Perceptron Model

2.1 Application to Software Teambuilding

The Fourteen training data set shown in the table 1 is having 5 personal features with different values assigned to each feature. These are the characteristics of the persons. Instead weights could be assigned to these parameters depending upon the degree of detail the person is holding that specific feature.

These weighted features can be used as the set of training features to the Fixed increment perceptron learning algorithm to classify the selection as either Yes or No leading to a 2-classificaion problem.

3. Fixed Increment Perceptron Learning Algorithm

Fixed input perceptron learning algorithm for a classification problem with n input features (X1, X2, X3…XN) and two output classes (0/1).

The algorithm is stated as below in Fig. 2.

Algorithm Fixed-Incr-Percept-Lrng (Xj, Yj, W)

Step 1: Create a perceptron with (N+1) input neurons X0, X1,…… XN where X0=1 is the bias value input. Let 0 be the output neuron.

Step 2: Initialize W = (W0, W1, ……., WN) to random weights.

Step 3: Iterate thought the input patterns Xj of the training set using the weight set, (i.e.) computer the weighted sum of inputs NETj = " XiWi , i = 1 to N For each input pattern j.

Step 4: Computer the output Yj using the step function Yj = f (NETj) = 1 , NETj > 0 = 0, otherwise

Step 5: Compare the computed output Yj with the target output Yj for each input pattern j. If all the input patterns have been classified correctly, output the weights & exit.

Step 6: Otherwise, update the weights as given below:

If the computed output Yj is 1 but should have been 0, Wi = Wi – A Xi, i = 0, 1, 2, ……..N.
If the computed output Yj is 0 but should have been 1, Wi = Wi + A Xi,, i = 0, 1, 2, …….N.

Here A is the learning parameter & is a constant.

Step 7: go to step 3.

End Fixed-Incr-Percept-Lrng.

Fig. 2 Fixed-Incr-Percept-Lrng Algorithm

4. Decision Tree Learning Appraoch

Decision tree learning [1] is one of the most widely used and practical methods for inductive learning. It is a method for approximating decision-valued target functions, in which a decision tree represents, learned function.

Here we take a hypothetical example to demonstrate how decision tree learning helps project manager to select people for a particular candidate project.

The information gain for each property decides which one should be tested first. First to measure the entropy, if the target attribute can take on c different values, than the entropy of S relative to this c-wise classification is defined as :

$$\text{Entropy}(S) = \sum_{i=1}^{c} -p_i \log 2\, p_i$$

Gain (S, A) is the reduction in entropy caused by knowing the value of attribute A.

$$\text{Gain}(S, A) = \text{Entropy}(S) - \sum_{A \text{ å } \text{Values}(A)} (Sv / S)\, \text{Entropy}(Sv)$$

4.1.1 1.1 Gain Calculation for Talent

Values (Talent) = Low, Medium, High

S = [9+, 5-]

$S_{Low} \leftarrow$ [2+, 3-]

$S_{Medium} \leftarrow$ [4+, 0-]

$S_{High} \leftarrow$ [3+, 2-]

$$\text{Gain}(S, \text{Talent}) = \text{Entropy}(S) - \sum_{A \text{ å } \{\text{Low, Medium, High}\}} (Sv / S)\, \text{Entropy}(Sv)$$

= Entropy (S)-5/14 Entropy (Low)-4/14 Entropy (Medium)-5/14 Entropy (High)

= 0.94-5/14(0.97)-4/14(0)-5/14(0.97)

= 0.247

Therefore, Gain (S, Talent) = 0.247

1.1.1 Entropy (S) Calculation:

$$\text{Entropy}([9+, 5-]) = -9/14 \log_2 (9/14) - (5/14) \log_2 (5/14)$$

$$= 0.94$$

4.2 1.2 Gain Calculation for Job Matching

Values (Job Matching) =Poor, Average, High

S=[9+, 5-]

S_{poor} [2+, 2-]

$S_{Average} \leftarrow$ [4+, 2-]

$S_{High} \leftarrow$ [3+, 1-]

$$\text{Gain}(S, \text{Job Matching}) = \text{Entropy}(S) - \sum (Sv / S)\, \text{Entropy}(Sv)$$

A å {Poor, Average, High}

= 0.94-4/14 Entropy (Poor)-6/14 Entropy (Average)-4/14Entropy (High)
= 0.94-0.2857-6/14 (o.9182)-4/14(0.81127)
= 0.94-0.911
=0.028

Therefore, Gain (S, Job Matching) = 0.028

4.3 1.3 Gain Calculation for Teambuilding

Values (Teambuilding) =Weak, Strong

S=[9+, 5-]
S_{weak}=[6+, 2-]
S_{strong}[3+,3-]
Gain (S, Teambuilding)= Entropy (S) - Σ (Sv / S) Entropy (Sv) A å {weak, strong}
= 0.94-8/14Entropy (Weak)-6/14Entropy (Strong)
= 0.94-8/14(0.81127)-6/14(1.0)
= 0.0478

Therefore, Gain (S, Teambuilding) =0.0478

4.4 1.4 Gain Calculation for Key Personal Relation

Values (Key Personal Relation) = Poor, Average, Good

S= [9+, 5-]
S_{Poor}=[1+, 2-]
$S_{Average}$=[3+, 2-]
S_{Good}=[5+, 1-]
Gain (S, Key Personal Relation) = Entropy (S) - Σ (Sv / S) Entropy (Sv)
A å {Poor, Average, Good}
= 0.94-(3/14) Entropy (Poor)-(5/14) Entropy (Average) – (6/14) Entropy (Good)
= 0.94-(3/14) (0.9182) – (5/14) (0.97) – (6/14) (0.65)
= 0.1182

Therefore, Gain (S, Key Personal Relation) = 0.1182

1.5 Gain Calculation for Training

Similarly,

Gain (Training) = 0.151

1.6 The information Gain values for all properties are :

Gain (S, Talent) = 0.247
Gain (S, Job Matching) = 0.028
Gain (S, Teambuilding) = 0.0478
Gain (S, Key Personal Relation) = 0.1182
Gain (S, Training) = 0.151

Where S denotes the collection of all training examples.

According to the information Gain measure, the talent property provides the best prediction of the target attribute selection, over the training examples. Therefore talent is selected as the decision attribute for the root node, and branches are created below the decision attribute for the root node.

If Talent is medium we select the person for the project team. Otherwise, we take next gain property. If Talent is low we make decision based on training. If Talent is High, we consider key personal relation as next gain value and continue to build the final decision tree as shown in the figure.

We can extend the similar approach for the project management activities based on decision tree learning and helps project managers for efficient project management and decision-making leading to successful software projects.

5. Future Work

Amongst the early NN architectures, Rosenblatt's Perceptron has found a prominent place, though it suffers from the drawback of weight determination only for linearly separable task.

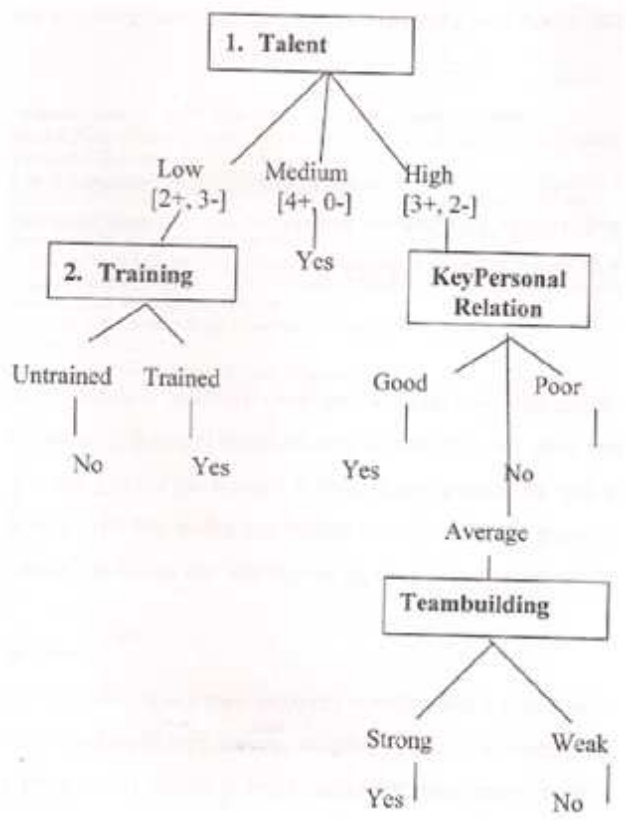

Fig. Final Decision Tree

We can carry out an analysis of applicability of other NN [5] like Back Propagation algorithm & its variations, evolving neural networks for more optimized results. Decision learning method does provide significantly improved decision making for software team formation.

However there is still scope for further optimization for the same by means of fuzzyfication of the DTL approach presented earlier. Genetic algorithms is another important paradigm in machine learning which could be deployed for achieving further improvements and obtaining satisfactory results. Evolving

neural networks which combines the ANN approach with Genetic Algorithms [9] can be of much use in eventual optimization of software formation process for software project management.

6. Conclusion

Using artificial neural network and DTL can carry out Teambuilding for software project management. Formation of Software team from the available human resources for a candidate software project is among the most challenging tasks faced by project managers. This software engineering work can be efficiently performed using ANNs and DTL.

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