Mining Efficient Fuzzy Bio-Statistical Rules for Association of Sandalwood in Pachaimalai Hills

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ABSTRACT

The integration of association rules and correlation rules with fuzzy logic can produce more abstract and flexible patterns for many real life problems, since many quantitative features in real world, especially surveying the frequency of plant association in any region is fuzzy in nature. This paper presents a modification of a previously reported algorithm for mining fuzzy association and correlation rules, defines the concept of fuzzy partial and semi-partial correlation rule mining, and presents an original algorithm for mining fuzzy data based on correlation rule mining. It adds a regression model to the procedure for mining fuzzy correlation rules in order to predict one data instance from contributing more than others. It also utilizes statistical analysis for the data and the experimental results show a very high utility of fuzzy association rules and fuzzy correlation rule mining in modeling plant association problems. The newly proposed algorithm is utilized for seeking close associations and relationships between a group of plant species clustering around Sandalwood in Pachaimalai hills, Eastern Ghats, Tamilnadu.

Keywords: Fuzzy Correlation Measure, Fuzzy Data Mining, Pachaimalai Hills, Plant Association

1. INTRODUCTION

Pachaimalai, also known as the Pachais (Pavendan & Rajasekaran, 2011), are hills which are part of Eastern Ghats in Tamil Nadu in Trichy district, located near 11°11′N 78°21′E / 11.18°N 78.35°E / 11.18; 78.35 (Figure 1). They are much greener than some of the other hills in the vicinity. VeeraRamar Dam is located in these hills on Kallar. Rivers include Kallar and Sweata Nadi. Waterfalls include Mangalam Aruvi, Koraiyar Falls and Mayil Uthu Falls. Jackfruit is one of the popular seasonal agriculture produce from this area. Towns in the area include: Thuraiyur, Esanai, Elambalur, Perambalur, Gangavalli, Thammampatti, Arumbavur, Malayalappatti, Thedavur and Uppiliapuram. Districts covered are Tiruchirappalli district, Salem District and

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Perambalur district. There are also indigenous tribes, such as the Malayalis, who trade some of their surplus agricultural products, which grow in the hills, to towns below on the plains, trading for items not available in the hills. They constitute an eastward extension of the Eastern Ghats in the northeastern Tamilnadu Uplands. The Pachaimalai Hills, together with the Javadi, Shevaroy, and Kalrayan hills, separate the Kaveri (Cauvery) River basin in the south from the Palar River basin in the north. Extending over an area of about 5,200 square miles (13,500 square km), they form a discontinuous line of highlands with a general elevation from 1,770 to 4,620 feet (540 to 1,400 metres). The hills are named for the Pachaimalaiyali peoples who live in the region. The Shangam period in Tamil literature flourished in the area during the Chera, Chola, and Pandya dynasties. The region consists of rounded hills composed of granitic gneiss. The hills have scrub jungles on broken ground and sal (Shorea robusta) forests on the flat hilltops. Loamy and clayey soils are found in the valleys. The Vellar, Palar, and Ponnaiyar rivers are dry for much of the year. The economy of the region is based on agriculture; rice, jowar (grain sorghum), sugarcane, gram (chickpeas), peanuts (groundnuts), and bajra (pearl millet) are subsistence crops. Coffee, cashews, and pepper are important plantation crops raised for export. Pachaimalai is known for its thick vegetation of Sandalwood and bamboo.

Santalum album or Indian sandalwood is a small tropical tree, and is the most commonly known source of sandalwood. This species has historically been cultivated, processed and traded since ancient times. Certain cultures place great significance on its fragrant and medicinal qualities. The high value of the species has caused its past exploitation, to the point where the wild population is vulnerable to extinction, especially in Pachaimalai hills known for its rich vegetation in sandalwood. Indian sandalwood still commands high prices for its essential oil, but due to the lack of sizable trees it is no longer used for fine wood working as before. The plant is widely cultivated and long lived, although harvest is viable after forty years. Etymologically it is derived from the Sanskrit word Chandanam. The height of the evergreen tree is between four and nine metres. The tree is variable in habitat, usually upright to sprawling, and may intertwine with other species. The plant parasitizes the root of other tree species, with an adaptation on its own roots, but without major detriment to its hosts. An individual will form a non-obligate relationship with a number of other plants. Up to 300 species (including its own) can host the tree’s development - supplying macronutrients phosphorus, nitrogen and potassium, and shade – especially during early phases of development establishing small stands. For a sandalwood tree a fruit is produced after three years and viable seeds after five years. These seeds are distributed by birds.

Plant association is defined as the grouping of plant species, or a plant community, that recurs across the landscape. Plant associations are used as indicators of environmental conditions such as temperature, moisture, light etc. It can be viewed as a collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance. In many cases there are several soil types within a given phytocoenosis. In community ecology and phytosociology, an association is a type of ecological community with a predictable species composition, consistent physiognomy (structural appearance) which occurs in a particular habitat type. The term Plant Association was first coined by Alexander Von Humboldt and formalised by the International Botanical Congress in 1910. Recently many researchers have concentrated on diverse types of plant associations (Johnson, 1992; Pavord, 2001; Nair, 2013; Schleicher et al., 2011; Willner, 2006; Yang et al., 2010). Data mining refers to extracting or “mining” knowledge from large amounts of data. The term is actually a misnomer. Nevertheless, mining is a vivid term characterizing the process that finds a small set of precious nuggets.
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