

<<Taikichiro Mori Memorial Research Fund>>
Graduate Student Researcher Development Grant
Application Form for the Academic Year 2016

Research Project: Semantic Analysis to Determine Deforestation Area and its Environmental Effect in Spatio-Temporal Space.

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Result of this project Research in Published Journals and conferences:

- [1] A Semantic Multispectral Images Analysis Retrieval Method for Interpreting Deforestation Effects in Soil Degradation. Irene Erlyn Wina Rachmawan, Yasushi Kiyoki, Under Review in International Journal of Information Modelling and Knowledge Bases, The 27th International Conference on Information Modelling and Knowledge Bases. EJC2017.
- [2] An Automatic Feature Extraction Method of Satellite Multispectral Images for Interpreting Deforestation Effects in Soil Degradation. Irene Erlyn Wina Rachmawan, Yasushi Kiyoki, Shiori Sasaki. Accepted and to appear in International Journal on Advanced Science, Engineering and Information Technology 2017.
- [3] a Cause-based Methodology for Semantic Analysis of Deforestation using Multispectral Reflectance. Irene Erlyn Wina Rachmawan, Yasushi Kiyoki, Shiori Sasaki. The 5th Indonesian-Japanese Conference on Knowledge Creation & Intelligent Computing (IEEE). Manado, Indonesia. 14-17 October 2016. Page 24.
- [4] Semantic Analysis of Deforestation Soil Effect using Multispectral Reflectance. Irene Erlyn Wina Rachmawan, Yasushi Kiyoki. International Electronics Symposium, Emerging Technology in Electronics and Information, Organized by Institute of Electricals and Electronics Engineering (IEEE). Bali, Indonesia. 29-30 September 2016. Page 70. **(Best Paper Award)**

Future Challenges:

- Semantic retrieval based on location and effect in global view for the analysis of deforestation in soil degradation
- The wide-area differential computing for deforestation effect on soil degradation

A Semantic Multispectral Images Analysis Retrieval Method for Interpreting Deforestation Effects in Soil Degradation

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Abstract. Deforestation is still a major nature phenomenon in our society. For assessing deforestation effect, satellites remote sensing provides a fundamental data for observation. While new remote-sensing technologies are able to represent high-resolution forest mapping, the application is still limited only for detecting and mapping the deforestation area. In this paper, we proposed a new method for retrieve the information contained on Satellite Multispectral images in order to interpreting deforestation effect in the context of soil degradation. We proposed an idea to interpret reflected “substances (material)” of bare soil in deforested area in spectrum domain into human language. The objectives of this paper are to (1) recognize the deforestation activity automatically. (2) Identify deforestation causes and examines the deforestation effect based on deforestation causes. (3) Scrutinize deforestation effects on soil degradation. (4) Representing nature knowledge of deforestation effect by performing calculation for semantic retrieval, to bring the clear comprehensible knowledge even for people who are not familiar with forestry. Semantic retrieval formed by understanding queries and showing queries result based on semantic calculation. As for experimental study, Riau Tropical Forest has been selected as the study area, where the multispectral data was acquired by using Landsat 8 Satellite between 2013 and 2014; Where forest fire and logging activities are reported and detected.

Keywords. Semantic, Computing, Retrieval, Multispectral image, Deforestation

1. Introduction

Deforestation is process of clearing and changing the main function of forest. During the massive activities on deforestation, it has been one of the major natural damage on earth. Several researchers deforestation analysis to serve the information regarding the current and trend of forest.

Deforestation rate increases each years, the present works have been dealt with mapping and measuring the rate over time and place. But the effect of deforestation was not been well reported. However, they do not work well when performing effective information retrieval in term of deforestation. For example, in the case of information serving, the effectiveness of information is low because the information only given by a large scale map of deforestation area.

2. Objective

In this research, we continuously improve our previous research in detecting deforestation area automatic and improve the ability of system to automatic give human interpretation using human labeling by using semantic computing. We develop multispectral image analysis and high-precise object-based detection method for representing the nature object and presenting the meaning using semantic computing.

3. System Design

To achieve automatic detection of deforestation area, we proposed new system consists of four processes: (A) Recognize the deforestation activity automatically. (B) Identify deforestation causes and examines the deforestation effect based on deforestation causes. (C) Scrutinize deforestation effects on soil degradation (D) Representing nature knowledge of deforestation effect in human language using semantic computing.

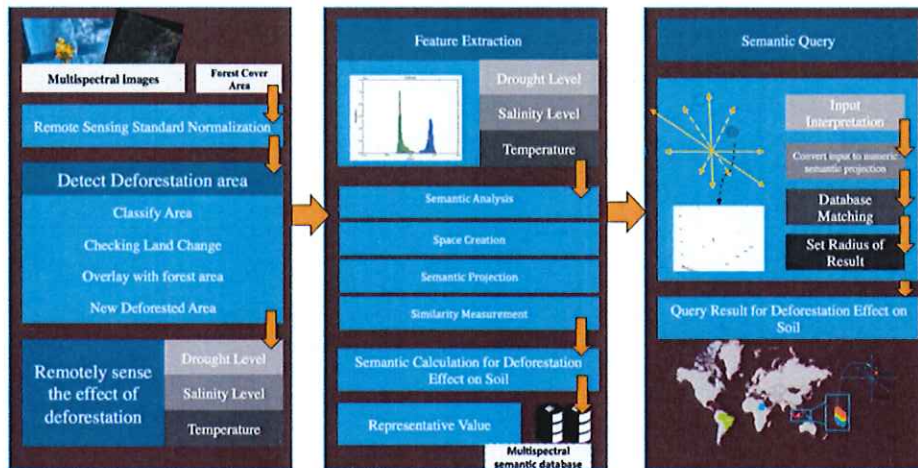


Figure 1. System design and proposal, processing system are including acquire data, DN to Reflectance Conversion, Deforestation Area detection and automatic cause-activity detection

4. Experimental Study

The progress of this research is we apply the semantic computing to interpret effect of soil condition in deforestation activity in language interpretation by using semantic analysis by using soil moisture and texture, soil temperature, and soil salinity. After converting multispectral images from DN to Reflectance, and process the language interpretation and semantic analysis, the semantic matrices for deforestation is produced.

a. Deforestation Causes and Effect

Different effects of deforestation are highly dependent on how deforestation activity taking place. Land conversion by cutting trees, Forest fire, and mining is three deforestation causes will be identified in our proposed system.

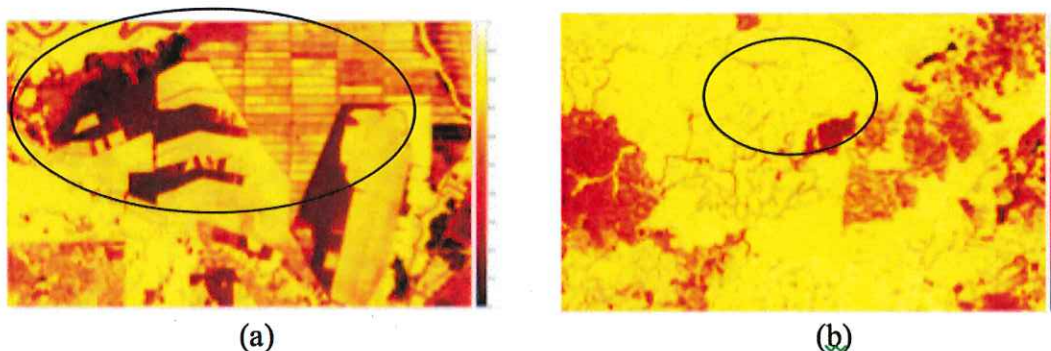


Figure 2. Normalized Burning Ratio value in two specific deforestation area was chosen, area (a) is a deforested area by burning-trees and area (b) is a deforested area by clear-cutting

b. Remote Sensing and Multispectral Analysis

Monitoring the deforestation activity is crucial for environmental changes, and remote sensing could provide data to be analyzed for modeling the effect caused by deforestation. As for the analysis of our research, which located in tropical region, another parameter will be considered before applying models. The regular variation of dry and wet seasons is also major reason for the changing of land cover along with human activities.

c. Semantic Analysis

Knowledge interpretation of deforestation effects will presented by using semantic analysis. By analyzing relationships between a set of natural value and the parameter they contain by producing a set of concepts related to the several natural condition.

long	lat	Word1	Word2	Word3	Word4
3047.00	2110.00	0.057	0.197	0.247	0.377
2237.00	3047.00	0.061	0.153	0.203	0.333
2007.00	3045.00	0.098	0.042	0.092	0.222
2002.00	3030.00	0.035	0.105	0.155	0.285
2045.00	2998.00	0.121	0.019	0.069	0.199
1789.00	3272.00	0.174	0.034	0.056	0.146
1925.00	2956.00	0.131	0.045	0.095	0.189
1929.00	2989.00	0.121	0.053	0.103	0.199
2006.00	2173.00	0.071	0.101	0.151	0.249
1892.00	2946.00	0.156	0.026	0.076	0.164
2101.00	2952.00	0.118	0.258	0.308	0.438
2125.00	3033.00	0.143	0.006	0.056	0.177
2244.00	3118.00	0.193	0.253	0.303	0.412
2232.00	3304.00	0.135	0.029	0.079	0.185
1787.00	3184.00	0.236	0.096	0.046	0.084
2062.00	2898.00	0.141	0.005	0.055	0.179
1265.00	6679.00	0.428	0.288	0.238	0.114

Figure 3. Semantic Interpretation in context of Plantation

PUBLICATIONS

Regarding this research on A Semantic Multispectral Images Analysis Retrieval Method for Interpreting Deforestation Effects in Soil Degradation system during April 2016-February 2017, we already published several papers. Here are results of our research:

- [1] A Semantic Multispectral Images Analysis Retrieval Method for Interpreting Deforestation Effects in Soil Degradation. Irene Erlyn Wina Rachmawan, Yasushi Kiyoki, Under Review in International Journal of Information Modelling and Knowledge Bases, The 27th International Conference on Information Modelling and Knowledge Bases. EJC2017.
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