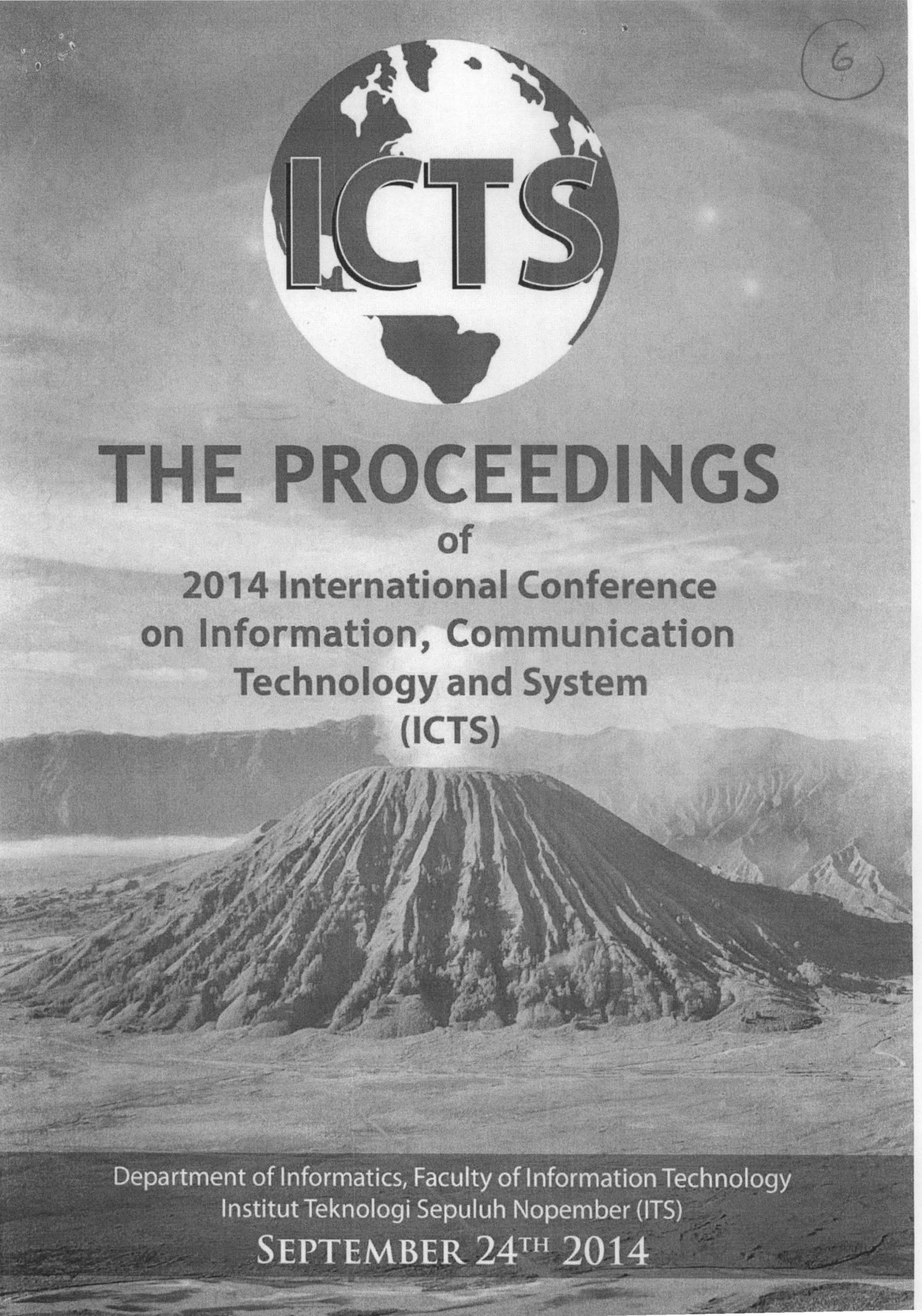

THE PROCEEDINGS

of

2014 International Conference on Information, Communication Technology and System (ICTS)

Department of Informatics, Faculty of Information Technology
Institut Teknologi Sepuluh Nopember (ITS)

SEPTEMBER 24TH 2014

2014 INTERNATIONAL CONFERENCE ON INFORMATION, COMMUNICATION TECHNOLOGY AND SYSTEM (ICTS)

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PROCEEDINGS OF

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Spectral Reflectance Estimation Based On Digital Leaf Image Using Wiener Estimation for Sambiloto Leaf Age Prediction

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***Abstract*— This research proposes a new method to estimate the spectral reflectance for Sambiloto (*Andrographis paniculata*) leaf age prediction based on leaf digital image. Sambiloto is a medicinal plant containing andrographolide compounds. Wiener estimation is used to estimate spectral reflectance based on RGB values and probabilistic neural networks (PNN) is used to classify plant age. Analyses of the result showed that the number of terms in the Wiener estimation affects on the results. According to experimental result, ten terms gave the best result for spectral reflectance estimation and accuracy of leaf age prediction is 73.61%. This prediction can be used as quality marker of medicinal plants.**

Keywords*— Polynomial, Probabilistic Neural Network, Spectral Reflectance Estimation, Sambiloto, Wiener Estimation.

I. INTRODUCTION

According to the world health organization report, there is an estimated 65 to 80% of the world's population relying on traditional (alternative) medicine as their primary form of healthcare [1]. Quality control of medicinal plants is very important. The quality of herbal medicines has a direct impact on their safety and efficacy [2]. Determination of the quality of medicinal plants is usually done in chemical laboratory. However, it is considered unfavorable because it can damage the medicinal plant samples, the processing time is quite long, and expensive.

Age of plant can be used as a quality marker of medicinal plant [3]. Age of medicinal plants can be seen from the brightness of leaf color. Generally, younger medicinal plants have lighter leaves colored, while the age-old medicinal plant has dark-colored leaves. Spectral reflectance represents physical information of an object surface. Reflectance measurements can be calculated using a spectrophotometer. Unfortunately, the acquisition of spectral images with a spectral camera is slow and the mobility of the equipment is poor [4].

To overcome these problems, other techniques are needed to conduct quality control of medicinal plants, namely the image processing. Spectral reflectance value can be estimated based on RGB values of leaf color. Wiener estimation spectrum imaging method has been utilized by [5] to estimate the content of the fish skin carotenoids arctic charr (*Salvelinus alpinus*) involving the reconstruction of reflectance spectra from RGB images. Research results showed that the reconstruction of reflectance spectra in frozen fish is better than fresh fish. Estimates of spectral reflectance of RGB image using Wiener Estimation methods have also been conducted by [4].

In this paper, leaf reflectance spectra of Sambiloto leaf have been investigated. Then, reflectance spectra is used to predict the age of Sambiloto leaf. The first step in our research was to find reflectance spectra using Wiener estimation. Second, predicting the leaf age of Sambiloto using probabilistic neural network.

II. WIENER ESTIMATION

The purpose of the Wiener estimation is to make estimations from low-dimensional data into high dimensional data, for example, from three-filter camera responses (RGB) into reflectance spectra. The wiener estimation is one of the conventional estimation methods which is quite simple and provides accurate estimates [5]. To estimate the reflectance spectra from the RGB can be denoted by [8]:

$$Y=XW \tag{1}$$

where X is matrix containing RGB values of the camera, Y is matrix containing spectra reflectance values, and W is transformation matrix mapping matrix X to matrix Y. Matrix W can be explicitly represented by the formula :

$$W=R_{rv}R^{-1}{}_{vv} \tag{2}$$

where R_{rv} and R_{vv} are correlation matrices, R_{rv} dan R_{vv} are defined as

$$R_{rv} = \langle rv^t \rangle, R_{vv} = \langle vv^t \rangle \tag{3}$$

In Eq. (3), r is an element column vector which corresponds to the reflectance spectrum of one pixel and v is an element column vector RGB.

As a result of the Wiener estimation for RGB images, we obtained the spectral images. In the Wiener estimation, there

are three terms, i.e., three, seven, and ten terms. Three types of polynomials used for leaf spectra reconstruction can be seen in Table 1.

TABLE I. TYPES OF POLYNOMIALS

Order	# *Terms*	Polynomial
1st order	3	R G B
2nd order	7	R G B R^2 G^2 B^2 RGB
3rd order	10	R G B R^2 G^2 B^2 RG RB GB RGB

III. ESTIMATION MEASUREMENT

In this research we used root-mean-square error (RMSE) and Goodness of Fit Coefficient (GFC) to evaluate estimation accuracy. RMSE is calculated using equation (4) .

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n} (s(i)-\tilde{s(i)})^2}{n}} \qquad (4)$$

where s is the original spectrum, $\tilde{s}$ is reconstructed spectra and n is number of wavelength component in spectra.

We evaluated the differences between the spectrum reconstruction and the original spectrum using Goodness of Fit Coefficient (GFC). GFC value is calculated using equation (5) [6].

$$GFC = \frac{|\sum_j R_m(\lambda_j) R_r(\lambda_j)|}{(|\sum_j [R_m(\lambda_j)]^2|)^{\frac{1}{2}} (\sum_j [R_r(\lambda_j)]^2)^{\frac{1}{2}}} \qquad (5)$$

where $R_m(\lambda_j)$ is original spectrum and $R_r(\lambda_j)$ is spectrum recontruction. As a goodness criterion, we considered the following:, GFC $\geq$ 0.9999 signifies almost an exact mathematical recovering *(excellent)*, 0.999 $\leq$ GFC < 0.9999 indicates quite good recovering (*very good)*, 0.99 $\leq$ GFC < 0.999 represents good recovering for colorimetric purposes (*good)*, dan GFC < 0.99 indicates *satisfactory of poor*.

IV. PROBABILISTIC NEURAL NETWORK

Probabilistic Neural Network (PNN) is a nonparametric classifiers that introduced by [7]. Probabilistic Neural Network (PNN) is a neural network that uses radial basis function (RBF). RBF is a function that is shaped like a bell that scales a nonlinear variable. The structure consists of four layers of PNN, the input layer, the layer patterns, layers, and layers of decision summation or output (Figure 1). In this research PNN is used to predict the leaf age of Sambiloto by classifying the reflectance spectra value into three classes (1 month, 2 months and 3 months).

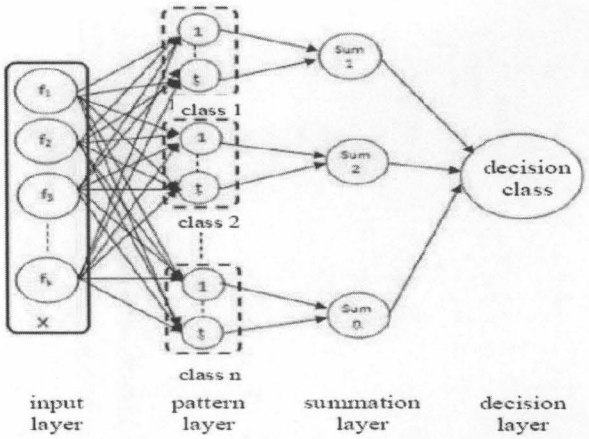

Fig 1. PNN structure

V. EXPERIMENTAL RESULT

A. Reflectance Estimation

For testing the polynomial transformation model, we used 97 standard colors, 46 species of leaf medicinal plants and 360 leaf of sambiloto as a training and test data. The images were taken from Arboretrum of Biopharmaca IPB. Fig 2 show the acquisition of spectral reflectance using spectrophotometer. Spectral reflectances were measured for each leaf in the visibility range 400-700 nm. Each spectral reflectances consist of 515 values.

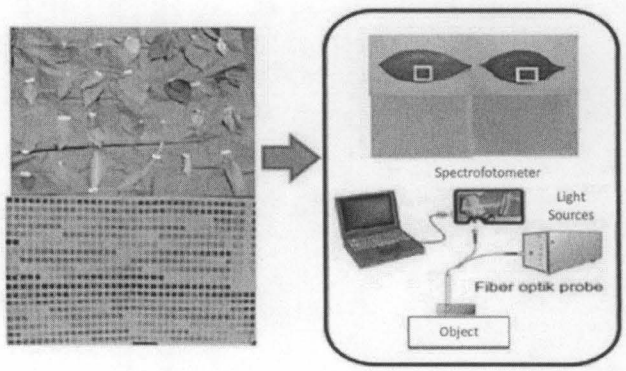

Fig 2. Acquisition of spectral reflectance using spectrophotometer

The experimental results showed that the ten terms or third order polynomial produces the best results or looks closer to the original than three and seven terms. It can be shown from RMSE and GFC value for ten terms are 13.29 and 0.96 respectively. Fig 3 shows the differences between spectrum

reconstruction and the original spectrum. Thus, this model was chosen as the best model for spectral reflectance estimation. Fig 4 showed spectral reflectance estimation for Sambiloto leaf age.

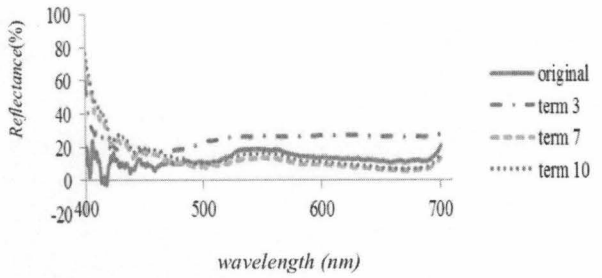

Fig 3. Spectral reflectance comparison

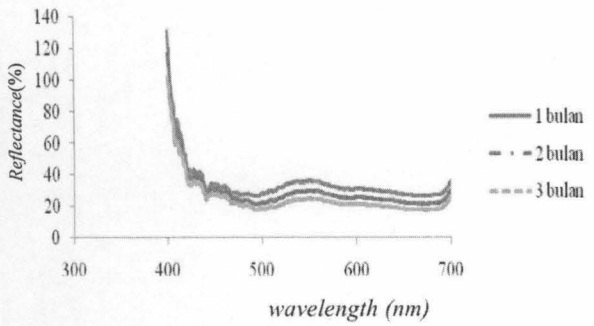

Fig 4. Spectral reflectance estimation

Analysis of spectral reflectance estimation revealed the following: the reflectance estimation of leaf for 1 month has the highest reflectance value. This is due to the facts that the young leaves containing little chemical compound, so the absorption of the younger leave is less than the older leave.

B. Leaf Age Prediction

We also analyzed prediction of leaf age using PNN based on the spectral reflectance estimation. For classification, the training and testing data were divided into 5-fold cross validation [9]. The number of training and test data are 288 and 72 leafs respectively. We inpu

The experimental result showed that the average accuracy are 73.61% (Table 2). The classification results are presented in confusion matrix (Table 3). It can be concluded that the spectral reflectance estimation can be used to predict leaf age of Sambiloto. The prediction of leaf age for 1 months has good accuracy. The other hand, the prediction of leaf age for 2 and 3 months often misclassified. This is caused by the estimation of spectral reflectance for 2 months and 3 months almost similar. To improve this accuracy, we can increase the number of data set.

TABLE II. ACCURACY OF CLASSIFICATION

Age (month)	Accuracy
1	95.83%
2	54.16%
3	70.83%
Average	73.61%

TABLE III. CONFUSSION MATRIX OF LEAF AGE CLASSIFICATION

		Age prediction (month)			Total
		1	2	3	
Actual class (month)	1	23	1	0	24
	2	2	13	9	24
	3	0	7	17	24

VI. CONCLUSION

We propose a new method to predict leaf age of Sambiloto based on spectral reflectance estimation using Wiener Estimation and PNN. Analyses of the result showed that the number of terms in the Wiener estimation affects on the results. We analyzed that the ten terms or third order polynomial produces the best results or looks closer to the original of spectral reflectance. This model was chosen to predict leaf age of Sambiloto. The experimental result showed that the accuracy of classification is 73.61%. We can conclude that the spectral reflectance estimation can be used to predict leaf age of sambiloto.

REFERENCES

[1] WHO. WHO: Geneva Switzerland; 1998. Quality control methods for medicinal plant materials. available at http://whqlibdoc.who.int/publications/1998/9241545100.pdf .

[2] Singh SK, Jha SK.Chaudhary, Yadava RDS, Rai SB. 2010. Quality control of herbal medicines by using spectroscopic techniques and multivariate statistical analysis. PharmaceutBiol. 48:134-141.

[3] Anuradha VE, Jaleel CA, Salem MA, Gomathinayagam M, Panneerselvam R. 2010. Plant growth regulators induced changes in antioxidant potential and andrographolide content in Andrographis paniculata Wall. exNees. Pesticide Biochemistry and Physiology. 98:312-316.

[4] Stigell P, Miyata K. Kasari MH. 2007. Wiener estimation method in estimating of spectral reflectance from RGB image. Pattern Recognition and Image Analysis. 17(2): 233-242. doi: 10.1134?s1054661807020101.

[5] Shatilova Y. 2008. Color image technique in fish research [tesis]. Joensuu (FI): Departement of Computer Science.University of Joensuu.

[6] Mansouri, A., Sliwa, T., Hardeberg, J. Y., Voisin, Y. Representation and estimation of spectral reflectances using projection on PCA and wavelet bases, CR&A,33(6), 2008

[7] Specht DF. 1990. Probabilistic neural networks. Neural Networks. 3:109-118

[8] Jetsu T, Heikkinem V, Parkkinen J, Kasari MH, Martinkauppi B, Lee SD, OK HW, Kim CY. 2006. Color calibration of digital camera using polynomial transformation. In Proceedings of CGIV2006 – 3rd European Conference on Colour in Graphics Imaging. and Vision; 2006 Jun 19-22; Leeds. Inggris. Leeds (UK): The Society for Imaging Science and Technology. hlm 163-166.

[9] Anguita D, Ghio A, Ridella S, Sterpi D. 2009. K-foldcross validation for error rate estimate in support vector machines. In Proc. DMIN [internet]. 2009 July 13-16; Las Vegas Amerika Serikat. Las Vegas (US). hlm 291-297.