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Hybrid Modeling for Forecasting of Domestic VFR Tourism Demand in Tehran

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Extended Abstract
Most management decisions at all levels of the organization directly or indirectly depend on the state of future prediction, and through the same prediction that one can imagine a success or a status in the future, thereby minimizing risk or making any adjustments and adaptations in the program (Inskeep, 2004).

Introduction
One of the most important events in the tourism industry of each country is the demand for a product or destination of tourism. But it should be noted that predictions can never match 100% of what happens in practice (Claveria & Torra,2014). There will always be distances and deviations between actual and predicted values, but the use of scientific and modern methods of forecasting will cause the results to reach far more than an objective estimate to the truth (Shen & Song,2011). In recent years, with the changing pattern of holidays and the formation of short-term holidays, cities have found the opportunity for tourism development.

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Materials and Methods

One of the most important types of domestic tourism in Tehran, based on the statistics of the National Center of Statistics and the views of the experts in this area, *is* **VFR tourism**. A definition was proposed by Backer (2003: 4); 'VFR Tourism is a form of tourism involving a visit whereby either (or both) the purpose of the trip or the type of accommodation involves visiting friends and/ or relatives.' This definition encompasses all VFR typologies and was put forward as a model (Backer, 2008b) to aid in explaining VFR typologies.

Table 1: VFR Travel Definitional Model

	Accommodation: Friends & family	Accommodation: Commercial
Purpose of Visit: VFR	✓	✓
Purpose of Visit: Non-VFR	✓	✗

Source: Backer, 2008b

As represented in the VFR Travel Definitional Model (table 1), VFRs can fall into a number of distinct groups. The category in the top left hand box depicts what could be considered to be the "pure" VFR, whose purpose is to visit their friends and or relatives and also stays with them. The lower left hand box depicts a less pure form of VFR traveler, who is staying with friends and relatives, but whose purpose of visit may be unrelated to VFR. This issue that VFR travelers can have a non-VFR purpose of visit when staying with friends or relatives has been discussed in previous research (Backer, 2003; Seaton & Palmer, 1997).

Discussion and Results

For this purpose, the present study seeks to propose models for forecasting effective variables on forecasting domestic business tourism demand in Tehran. To do this, information was used between the years 2001 to 2015. Independent variable of this study is the number of domestic VFR tourists in Tehran, and dependent variables were selected based on Delphi and Fuzzy DEMATEL techniques. The model framework is a combination of regression, fuzzy neural network, and SVR algorithm, which combines these methods to measure forecast errors and compare the methods.

Conclusion

The results of this research show that the proposed hybrid approach of regression and Adaptive Neuro-Fuzzy Inference System (ANFIS) can have better prediction than other methods for forecasting domestic VFR tourism.

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Table2: Test results of different methods on the demand of domestic VFR tourism in Tehran (evaluation data)

		MSE	RMSE	NMSE	R^2	MAE	MAPE
VFR Tourism	regression	0.001785	0.042249	0.025412	0.974588	0.000493	0.049325
	fuzzy neural network	0.001395	0.037349	0.019856	0.980144	0.000436	0.043579
	SVR algorithm	0.061316	0.247621	0.872842	0.127158	0.002746	0.274595
	hybrid approach of regression and SVR algorithm	1.24E-05	0.003521	0.000177	0.999823	3.28E-05	0.00328
	hybrid approach of regression and Adaptive Neuro Fuzzy Inference System (ANFIS)	**8.74E-06**	**0.002956**	**0.000124**	**0.999876**	**2.78E-05**	**0.002779**

Keywords: regression, adaptive neuro-fuzzy inference system (ANFIS), Support Vector Regression (SVR) Algorithm, VFR tourism, forecasting of domestic VFR tourism demand, Tehran.

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