The Characteristic Analysis and Forecasting of Mid-Long Term Load Based on Spatial Autoregressive Model

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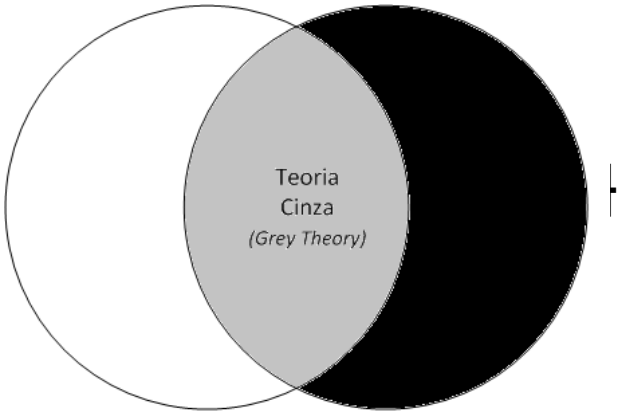
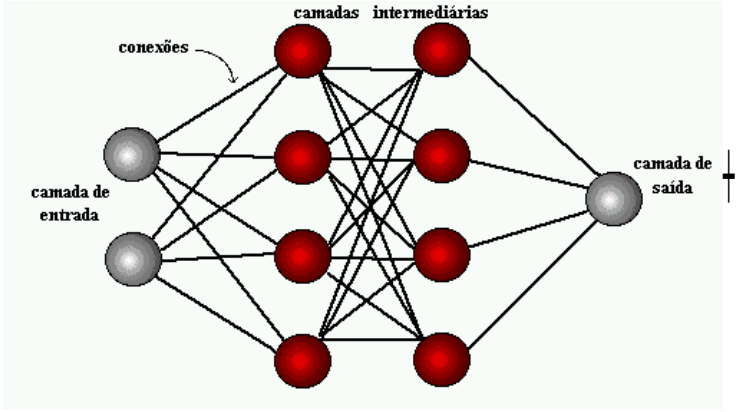
Objetivo:

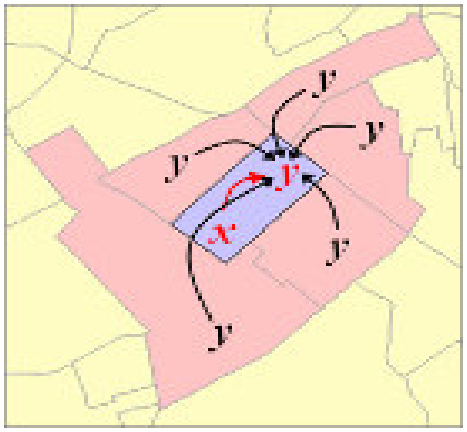
- Analisar a característica espacial entre o consumo de energia e PIB.
- Um modelo combinado é apresentado:



GM (1,1)

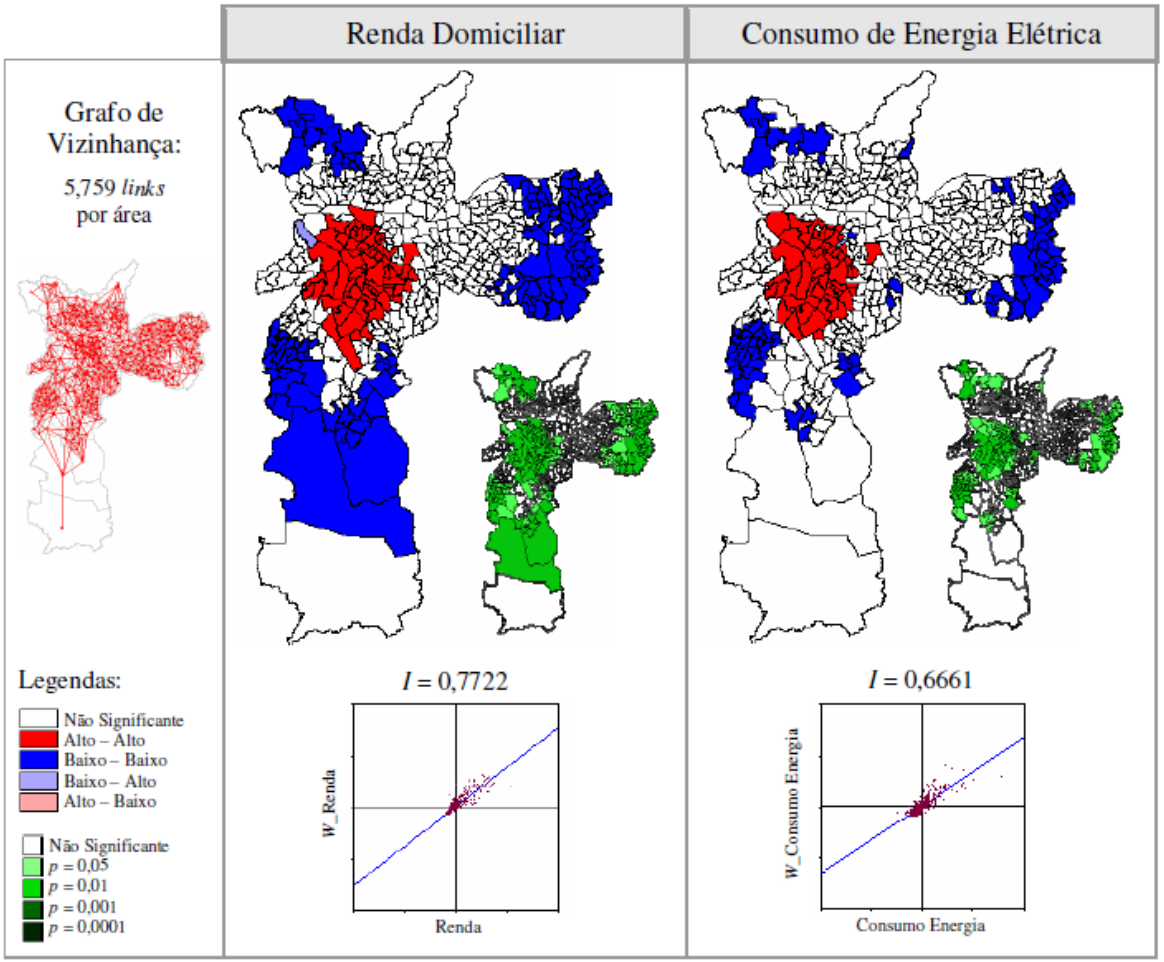


RN



SAR

Porque é importante realizar um análise especial?:



Modelo Cinza (GM) (1,1)

- Passo 1: $X^0 = \left[x^0(1), x^0(2), \ldots, x^0(n)\right]$ Na qual: $x^0(i)$

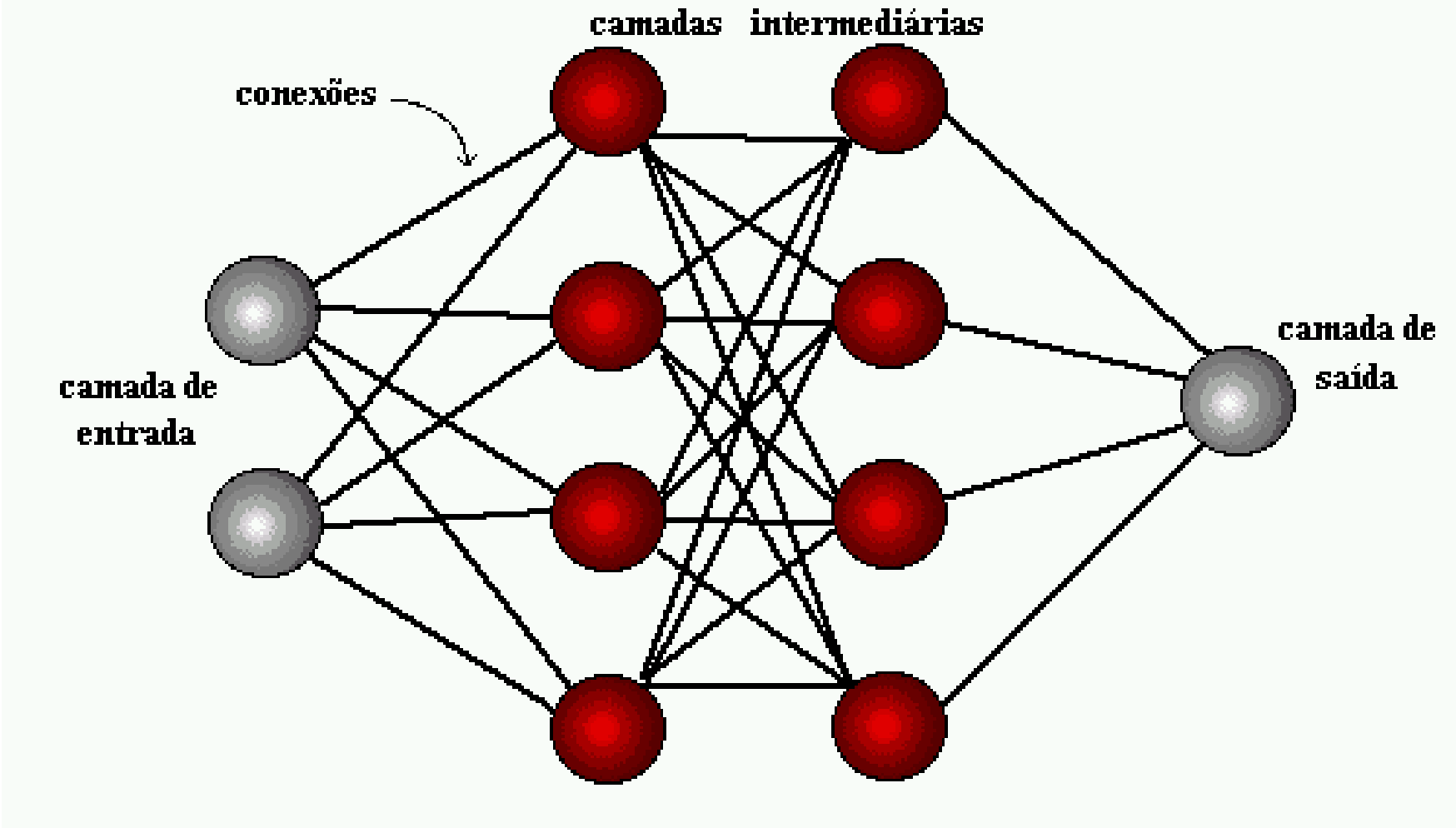
- Passo 2: $X^1 = \left[x^1(1), x^1(2), \ldots, x^1(n)\right]$ Sendo que : $x^1(k) = \sum_{m=1}^{k} x^0(m)$

- Passo 3: $\frac{dx^1(k)}{dk} + ax^1(k) = u$

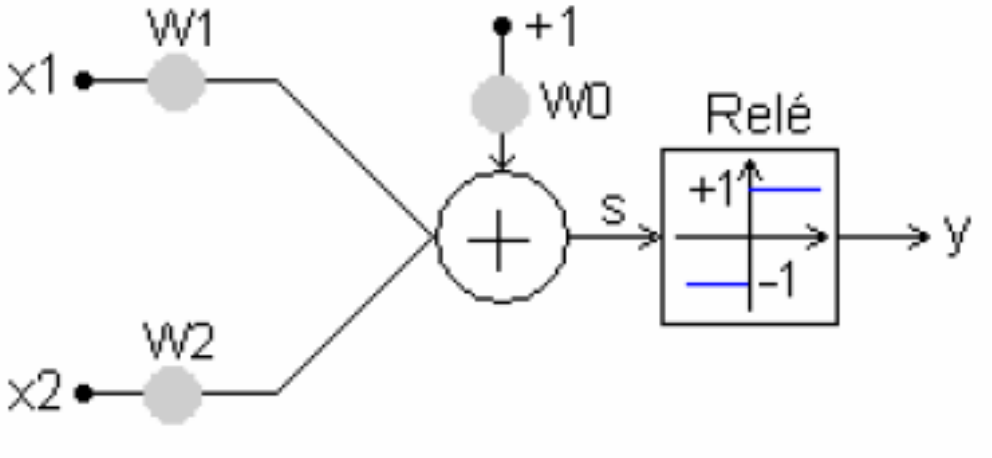
- A função de predição : $\hat{x}^1(k) = (x^1(1) - \frac{u}{a})e^{-ak} + \frac{u}{a}$

  Para o tempo *k+1* : $\hat{x}^0(k+1) = \hat{x}^1(k+1) - \hat{x}^1(k)$

Rede Neuronal



Rede Neuronal



$$s = W1\,x1 + W2\,x2 + W0$$

Modelo Espacial Autorregressivo :

$$y = \rho W_1 y + X\beta + \mu$$

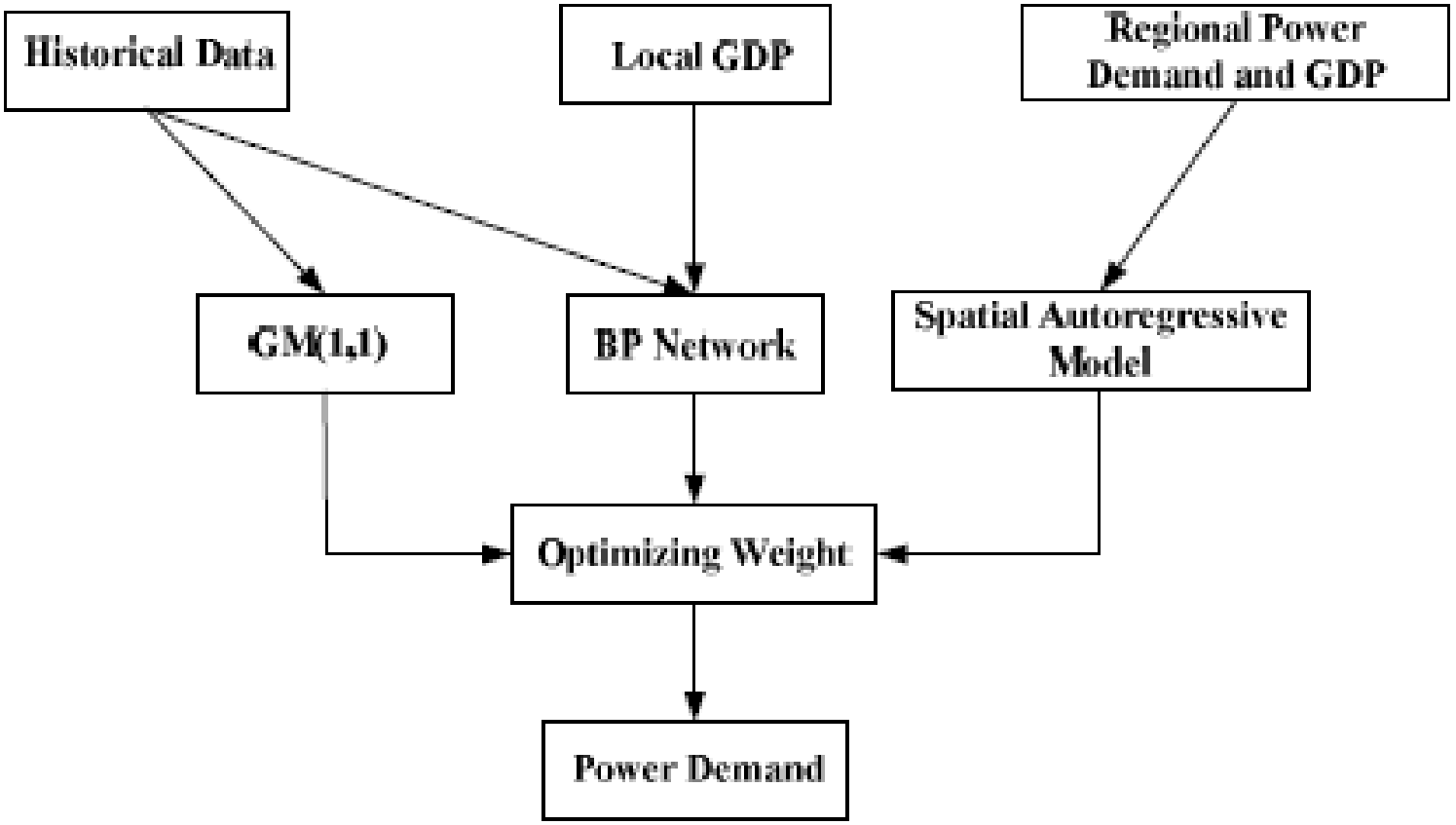
$$\mu = \lambda W_2 \mu + \varepsilon$$

$$\varepsilon \sim N(0, \sigma^2, I_n)$$

Modelo de Otimização:

$$\begin{cases} \min J = e \qquad e = \left| y - \hat{y} \right| \\ \hat{y} = \sum_{i=1}^{m} \omega_i f_i \\ \sum_{i=1}^{m} \omega_i = 1 \\ \omega_i \geq 0 \quad i = 1, 2, \cdots\cdots m \end{cases}$$

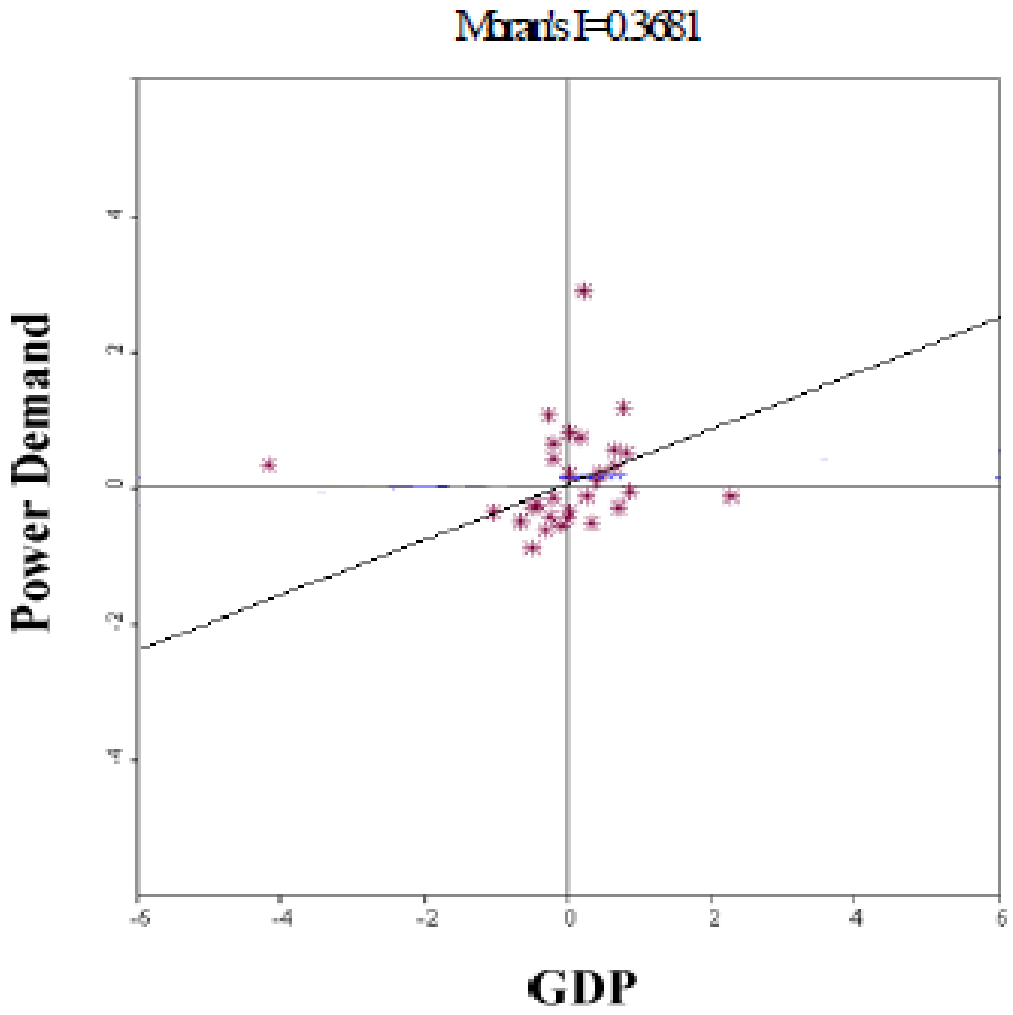
Modelo Combinado:



Resultados dos Modelos:

Model	Constant	β	ρ	λ	R^2
Regression Model	208.45 （0.001）	0.082 （0.008）			0.4571
Residual Spatially Autoregressive Model	236.21 （0.00）	0.061 （0.00）		0.6224 （0.00）	0.9112
Hybrid Spatially Autoregressive Model	176.32 （0.00）	0.053 （0.001）	0.4681 （0.00）		0.8252

Moran Scatterplot:



Previsão de Demanda:

Tab.2 Data for forecasting

Year	2001	2002	2003	2004	2005
Power Demand (10^9kwh)	295.08	306.27	338.7	371.8	378.22

Tab.3 Forecasting results

Method		Year	2006	2007
		Actual Value	412.26	466
Model Ⅰ	Forecasted Facts	Forecasted Value	397.83	447.83
		Error (%)	3.5	3.9
	Actul Facts	Forecasted Value	401.13	451.09
		Error (%)	2.7	3.2
Model Ⅱ	Forecasted Facts	Forecasted Value	433.7	448.84
		Error (%)	5.2	5.4
	Actul Facts	Forecasted Value	431.22	443.17
		Error (%)	4.6	4.9

Comentários:

- Não se mencionaram características da área de estudo.
- Foi dada pouca informação dos modelos e as referências utilizadas são muito gerais para cada modelo.
- Deve fazer-se um comentário do poder preditivo dos modelos autorregressivos.
- Este artigo contribui com considerar modelos de regressão espacial dentro do estudo do consumo de energia nos sistemas elétricos.

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• Tieding, L.; Shijian, Z.; Wei, L.; Liting, Z. An improved algorithm of grey model-GM(1,1) based on total least squares and its application in deformation forecast. In: GREY SYSTEMS AND INTELLIGENT SERVICES, 2009. **Conference proceedings**... IEEE, 2009. p. 362 – 366.

• Saini, M.; Soni, K. Artificial neural network-based peak load forecasting using conjugate gradient methods. **IEEE Trans on Power Systems**, Vol.17, pp. 907-912, 2002

Obrigado pela atenção

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