Spectral Temporal Approach by Response Surface (STARS): Methodology
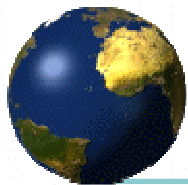
Márcio Pupin de Mello*

Colaboradores: Dr. Carlos Antonio Oliveira Vieira (UFV)
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✓ Dados de Sensoriamento Remoto

- Multiespectral

- Multitemporal

- Caracterização da superfície da Terra

- Detecção e monitoramento de mudanças

  - Práticas agrícolas

  - Desmatamento

    - Padrões ("*Signature Change Pattern*")

✓ Existe uma maneira de sintetizar os dados de uma serie temporal de imagens multiespectrais?

✓ Essa possível metodologia poderia representar as assinaturas de mudança?

Objetivos

✓ **Descrever a metodologia STARS**

- **Estatística clássica**
- **Geo-estatística**

✓ **Apresentar sua capacidade de representação**

- **Um caso de aplicação**
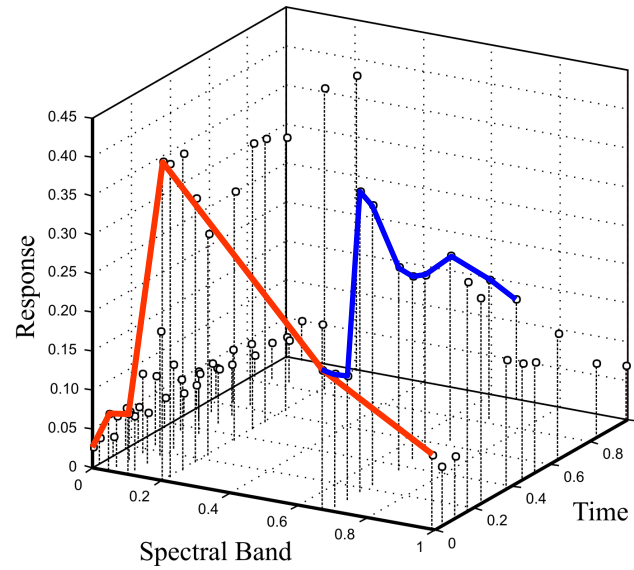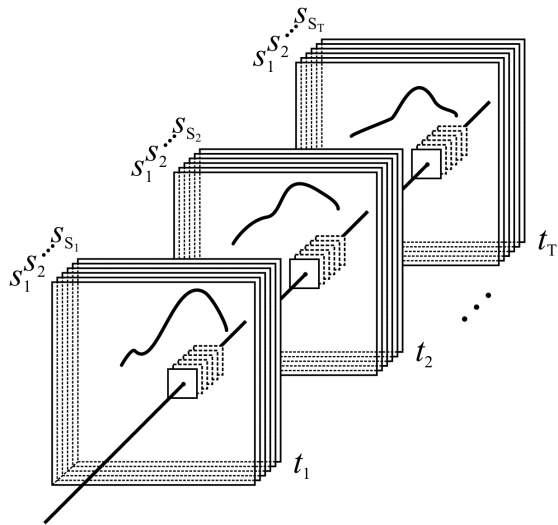 - Colheita da cana-de-açúcar

Metodologia (visão geral)
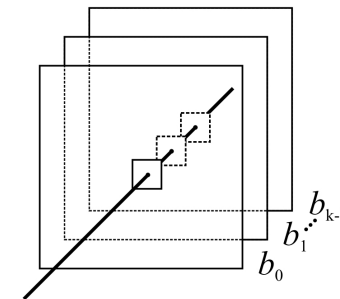

Multispectral imagery over time   STS points   STARS image

$$r = f(t, s)$$

$$r = \beta_0 + \beta_1 t + \beta_2 s + \cdots + \beta_{k-1} s^d + \varepsilon$$
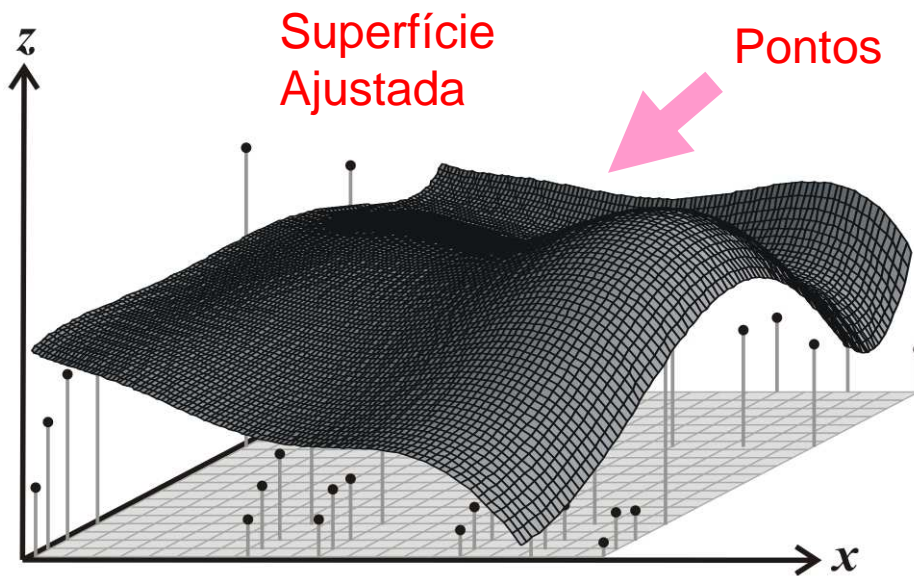
O ajuste da superfície

Superfície de Tendência Polinomial
(PTS: *Polynomial Trend Surface*)

Grau do polinômio = 3

$$\hat{z} = f(x, y) = a_0 + a_1 x + a_2 y + a_3 x^2 + a_4 xy + a_5 y^2 + a_6 x^3 + a_7 x^2 y + \cdots + a_{\frac{(d+1)(d+2)-2}{2}} y^d$$

$$\hat{z} = f(x, y) = 0,08 + 0,47x + 2,42y - 3,99x^2 - 1,25xy - 27,81y^2 + 9,90x^3 - 0,31x^2 y + \cdots + 107,20y^3$$

Superfície Ajustada

Pontos

Método dos Mínimos Quadrados (MMQ)

observacoes = pontos do espaço espectro temporal

incógnitas = coeficientes (a_i)

✓ Estatística Clássica...

$$b = \left(X'X\right)^{-1} X'r$$

✓ Geo-estatística...

$$b = \left(X'V^{-1}X\right)^{-1} X'V^{-1}r$$

Motivação

Research

The Impact of Sugar Cane–Burning Emissions on the Respiratory System of Children and the Elderly

José E.D. Cançado,[1] Paulo H.N. Saldiva,[1] Luiz A.A. Pereira,[1,2] Luciene B.L.S. Lara,[2] Paulo Artaxo,[4] Luiz A. Martinelli,[3] Marcos A. Arbex,[1,5] Antonella Zanobetti,[6] and Alfesio L.F. Braga[1,2,7]

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Expansion of sugarcane production in São Paulo, Brazil: Implications for fire occurrence and respiratory health

María Uriarte *, Charles B. Yackulic, Tamar Cooper, Dan Flynn, Marina Cortes, Tanja Crk, Georgina Cullman, Meghan McGinty, Jason Sircely

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ARTICLE INFO

ABSTRACT

Recent increases in the price of oil have generated much interest in biofuel development but the social and environmental impacts of large scale adoption of biofuels at both regional and national scales remain ___ ___ prices for oil may slow ___ $50/

Use of post-harvest sugarcane residue for ethanol production

Letha Dawson, Raj Boopathy *

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Available online 28 August 2006

Abstract

Agricultural residues are produced in large quantities throughout the world. Approximately, 1 kg of residue is produced for each kilo-gram of grains harvested. This ratio of grain/residue translates into an excess of 40 billion ton of crop residue produced each year in the ___ ___ renewable ___
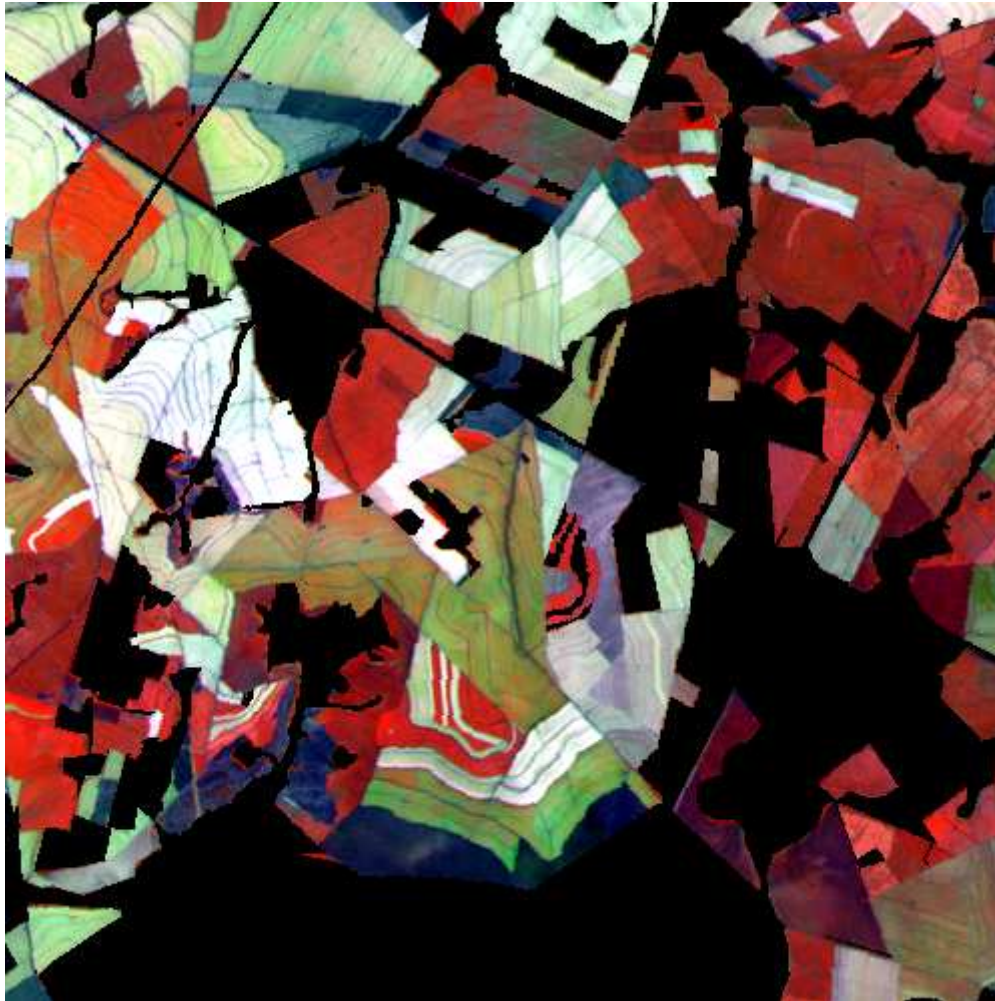
"Se 10% do combustível fóssil do mundo vier a ser substituído por etanol, a mistura E10 traria um benefício ambiental considerável, e criaria mais empregos"

(*José Serra*)

✓ Comportamento espectro-temporal da colheita

- Padrão visual (composição R4G5B3)
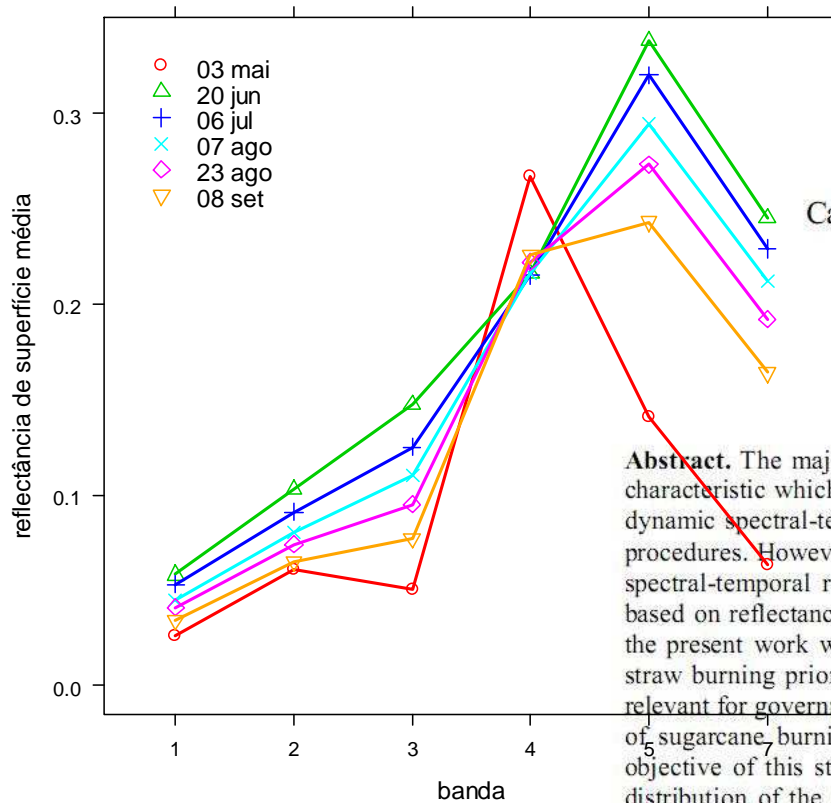

Data1 ⬅

Data2

Data3

Data4

Data5

Data6

XIV SBSR

Comportamento espectro-temporal da cana-de-açúcar: uma nova proposta na distribuição espacial dos pontos de controle utilizados na interpolação de superfícies de resposta espectro-temporais

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Cana Crua

Abstract. The major attribute of remotely sensed images to observe the land surface is the spectral-temporal characteristic which is paramount for accurate agricultural crop area classification. Agricultural targets present a dynamic spectral-temporal behavior that is very helpful to discriminate among different crops in classification procedures. However, there are only few methods that address this issue in depth. One promising method is the spectral-temporal response surfaces (STRS) approach which uses control points to define response surfaces based on reflectance observed for specific targets of interest at specific spectral bands and at specific dates. In the present work was analyzed the spectral-temporal behavior of sugarcane fields harvested with and without straw burning prior to harvest. The information about sugarcane harvested with and without straw burning is relevant for government control to evaluate the effectiveness of the effort to gradually reduce the harvest practice of sugarcane burning which should cease by 2014 for fields that can be mechanical cultivated. The major objective of this study is to improve the STRS interpolation method. Therefore, two methods for the spatial distribution of the control points were compared. Three sugarcane classes (non-burned cane, burned cane and non-harvested cane) were investigated using 5,000 samples for each class and six Landsat5/TM images acquired from April to September 2007 to interpolate the STRS. Best result was obtained using the method of equidistant values distribution for the wavelength axis. With this new interpolation method it is expected to largely improve the classification of sugarcane fields harvested with different harvest practices.
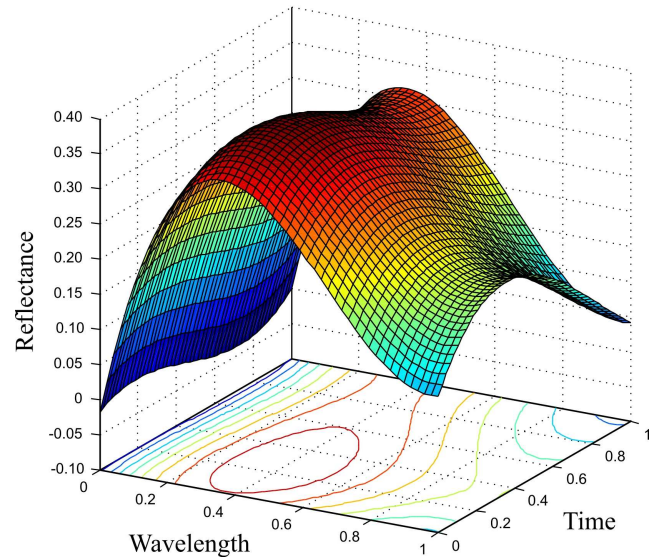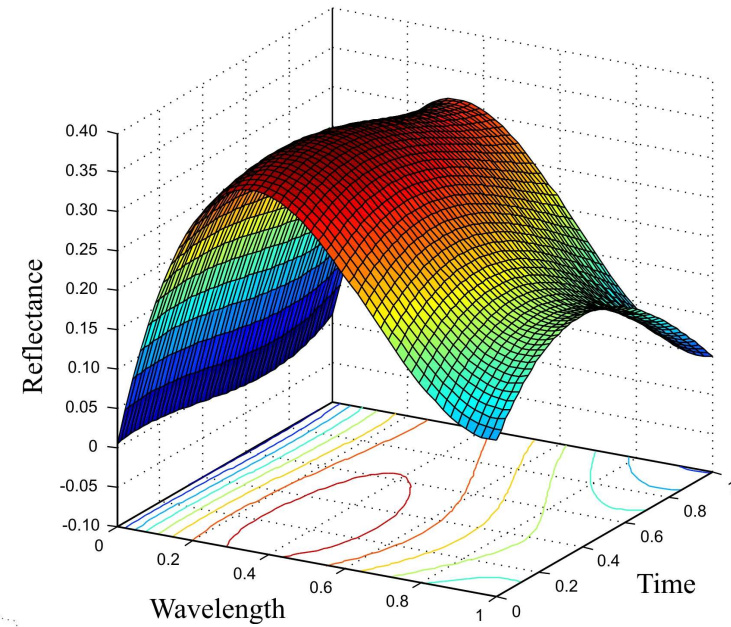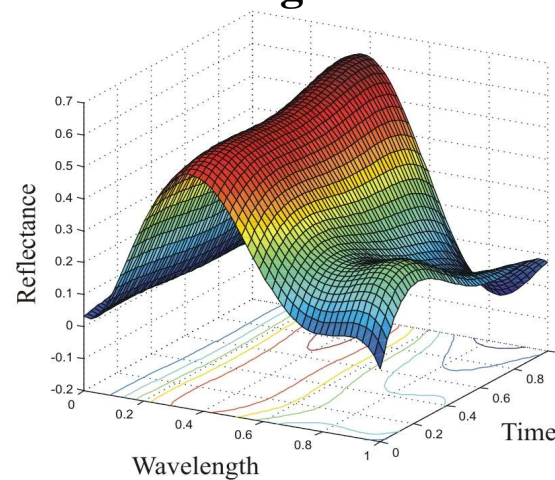
Semivariogram
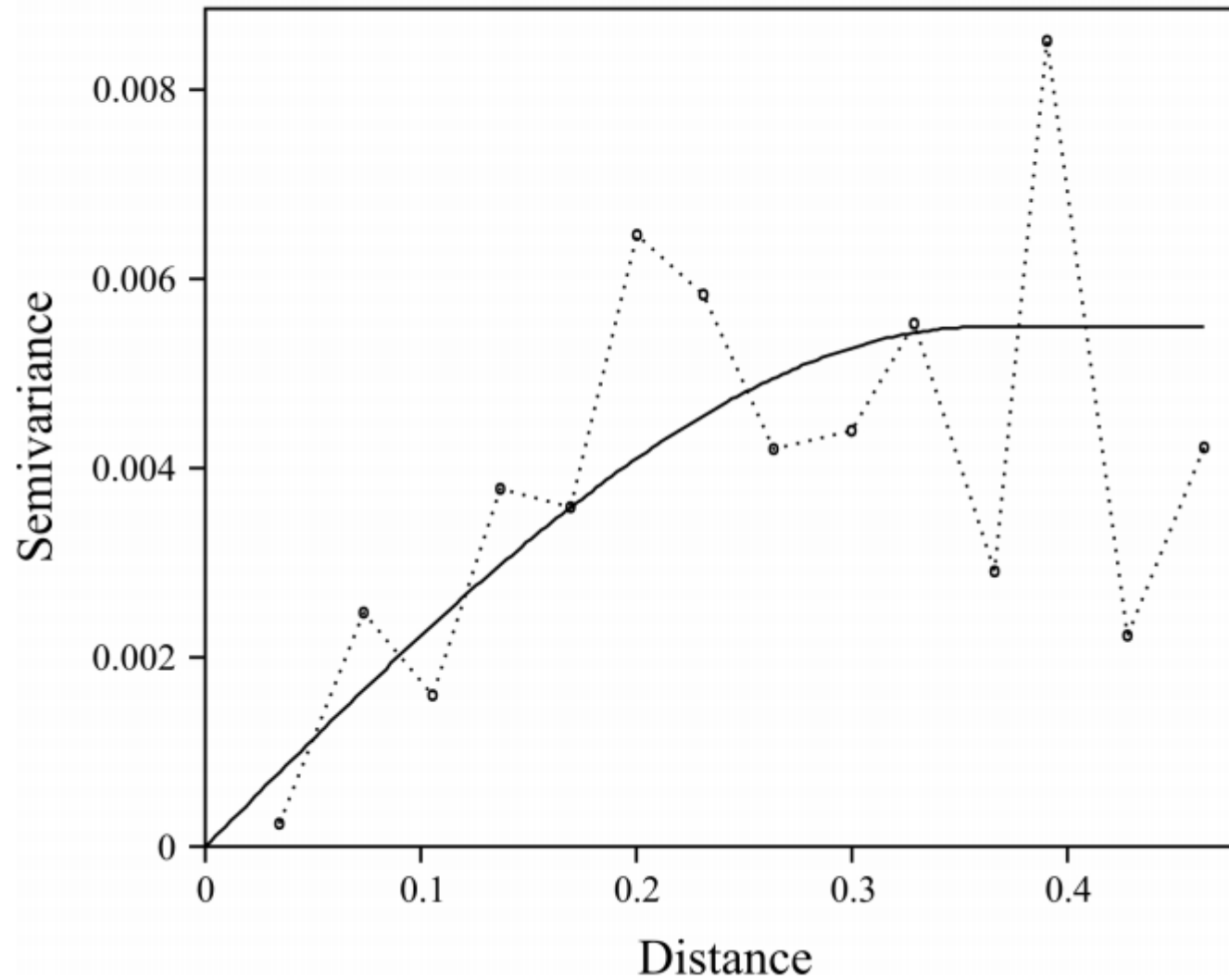
Independence Assumption

Dependence Assumption

Degree = 5

O STARS está no R!!!

✓ Classificar a imagem STARS

✓ Verificar seus padrões

✓ Testar modelos

✓ ...
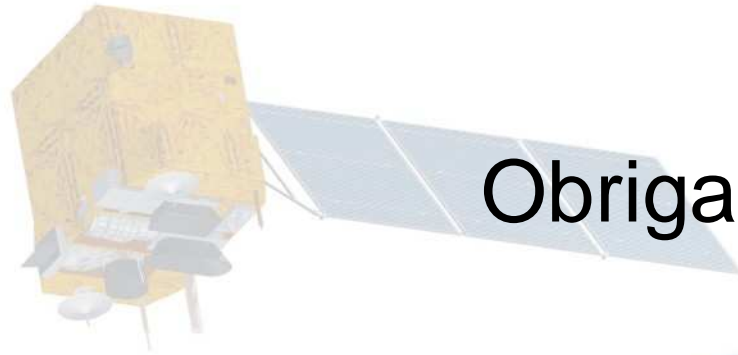
Obrigado!

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