



Vessel Extraction Using the Buckmaster-Airy Filter

Proposal presentation
August 28, 2015

Student:
Valentina Sanchez-Bermudez
Mathematical Engineering

Tutor:
Juan Fernando Ospina-Giraldo
Logic and Computation
Research Group

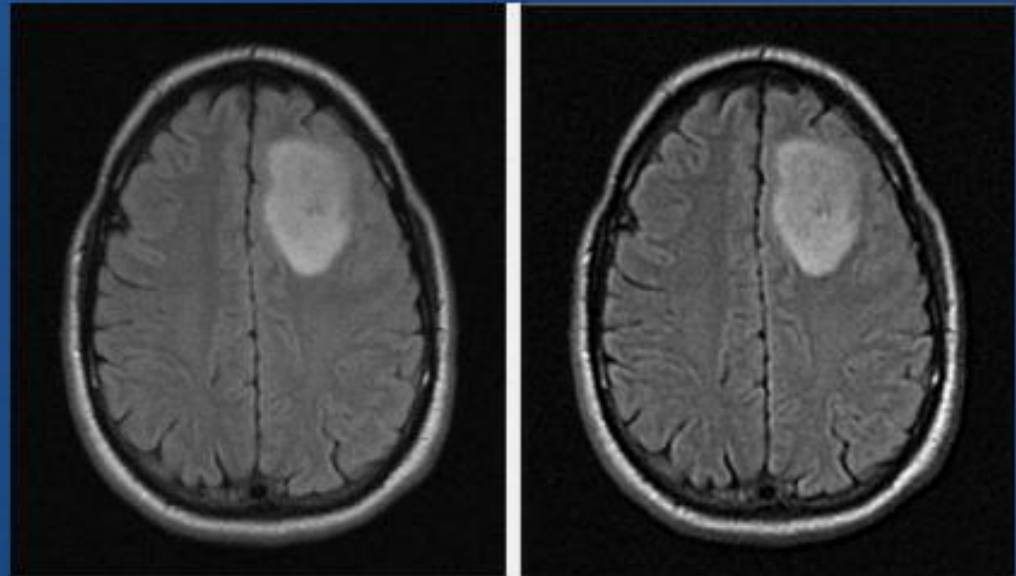


Outline

1. Introduction
2. Problem description
3. Preceding researches
4. Objectives
5. Methodology
6. References

Introduction

Vessel extraction is important for the analysis of biomedical images of vessels, using partial differential equations and special functions of mathematical physics we can create a filter which can be used for a better visualization for black and white images.





Problem description

Linear dispersion equation:

$$\frac{\partial}{\partial x} P(x, y, t) = \eta_1 \left(\frac{\partial^3}{\partial x^3} P(x, y, t) \right) + \eta_2 \left(\frac{\partial^3}{\partial y^3} P(x, y, t) \right)$$

Initial condition:

$$P(x, y, 0) = \delta(x - X) + \delta(y - Y)$$



Problem description

Buckmaster equation:

$$\begin{aligned} \frac{\partial}{\partial t} u(x, y, t) = & \left(\frac{\partial^2}{\partial x^2} u(x, y, t)^4 \right) + \left(\frac{\partial}{\partial x} u(x, y, t)^3 \right) \\ & + \left(\frac{\partial^2}{\partial y^2} u(x, y, t)^4 \right) + \left(\frac{\partial}{\partial y} u(x, y, t)^3 \right) \end{aligned}$$



Preceding researches

Binford (1971) [1] introduces the Generalized Cylinders Model in vision application.

Some categories for vessel extraction techniques [2]:

1. Pattern recognition techniques
2. Model-based approaches
3. Tracking-based approaches
4. Artificial intelligence-based approaches
5. Neural network-based approaches
6. Miscellaneous tube-like object detection approaches



Ojectives

Design a technique for vessel extraction from biomedical images using the Buckmaster-Airy filter.

- Develop a filter for biomedical images processing using partial differential equations.
- Compare the performance of the Buckmaster-Airy filter with other filters obtained from partial differential equations.
- Present the results of the project in an international conference.



Methodology

1. Computational propadeutics with Maple
2. Reading relevant papers
3. Construction of the model
4. Computational implementation of the model
5. Writing the paper



References

- [1] T.O. Binford, “Visual perception by computer”, in *IEEE conference on System and Control*, vol. 261, p. 262, 1971.
- [2] C. Kirbas and F. Quek, “A review of vessels extractions techniques and algorithms”, *ACM Computing Surveys (CSUR)*, vol. 36, no. 2, pp. 81-121,2004.