Vesselness Filters: A Survey with Benchmarks Applied to Liver Imaging

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Benchmark Features [1]

- Customizable vessel filters, data masks and metrics
- Online demonstration
- Reproducible experiments

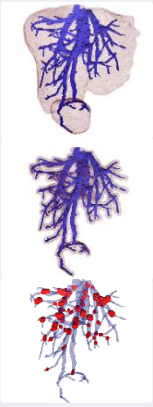
Vesselness Filters

Filters	Type
[Sato, 1997]	Hessian
[Frangi, 1998]	
[Meijering, 2004]	
[OOF, 2010]	
[Jerman, 2015]	
[Zhang, 2018]	
[RORPO, 2019]	Morphology

DATA

Dataset	Transformations
Ircad [2]	Isotropic voxels
Vascusynth [3]	3 levels of noise + intensity artefacts

Area of interest



Liver/whole volume

Vessels neighbourhood

Bifurcations

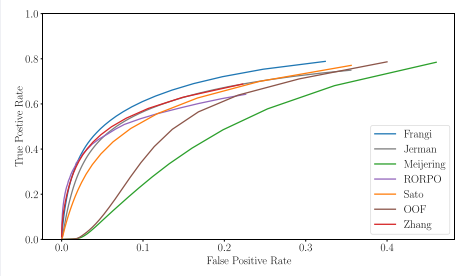
Introduction

Vessels segmentation often relies on a vessel filtering step. However, selecting a filter for an application is a challenging problem using the literature alone. We have chosen 7 methods representative of the last 20 years of vesselness enhancement and designed a common comparison framework to help the community compare these filters.

Experiments

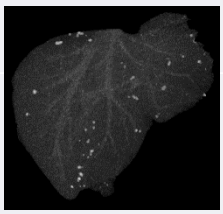
We compared the effect of these filters on 3 differents areas of interest using the following metrics :

- **MCC**
- **Dice**
- **ROC curves**

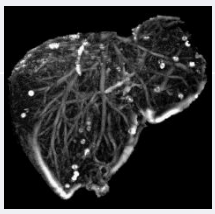


ROC curve – Ircad, whole liver

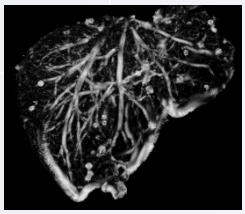
Visual Results



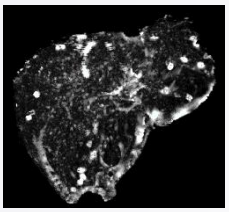
Input volume



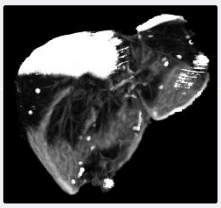
Sato



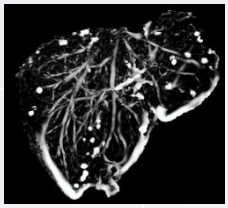
Frangi



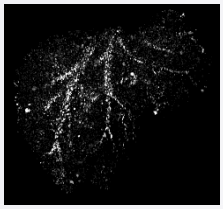
Meijering



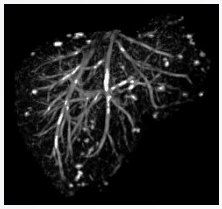
OOF



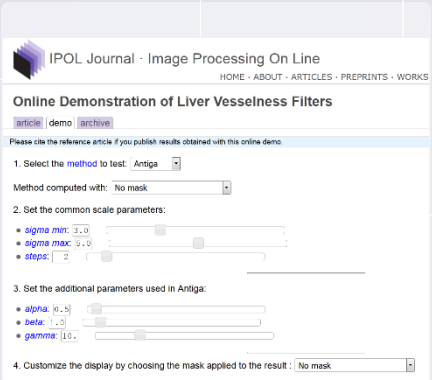
Jerman



RORPO



Zhang



Customizable filters parameters

Online Demonstration [4]

The online demonstration allows the user to test the vesselness filters on existing volumes and his/her own uploaded volumes.

[1] https://github.com/JonasLamy/LiverVesselness
[2] https://www.ircad.fr/fr/recherche/3d-ircadb-01-fr
[3] http://vascusynth.cs.sfu.ca/Data.html
[4]https://kerautret.github.io/LiverVesselnessIPOLDemo/