Cardiac pathology prediction according to convolutional methods with kinematic features

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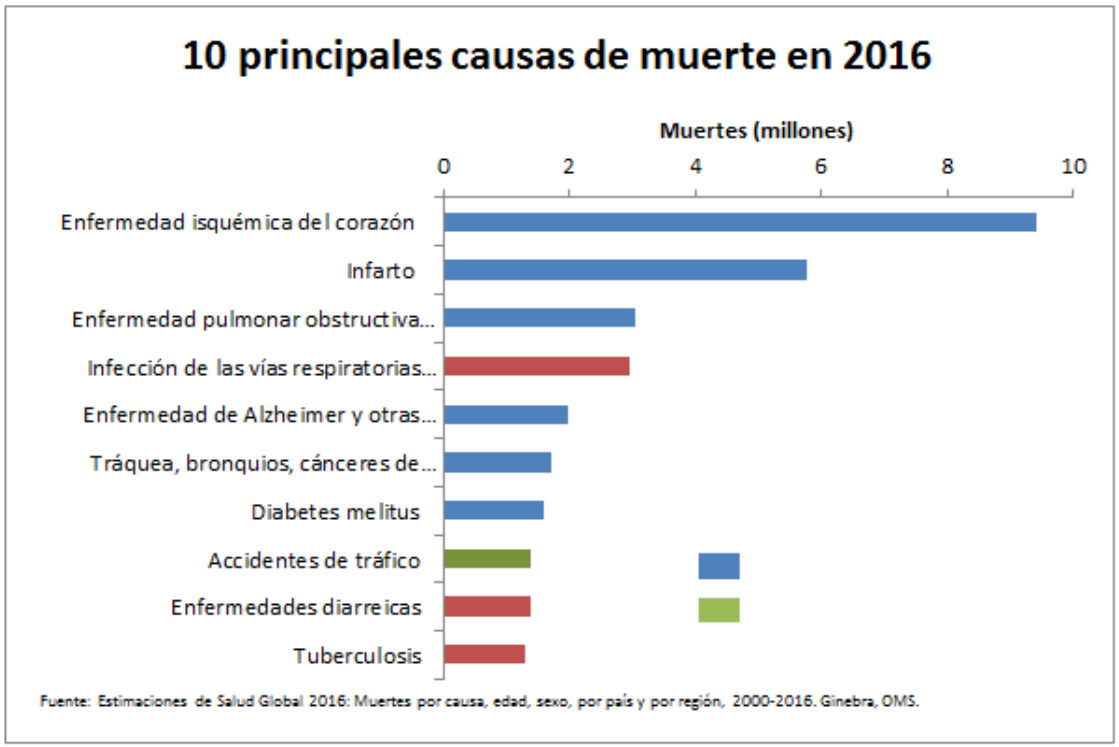
Introduction

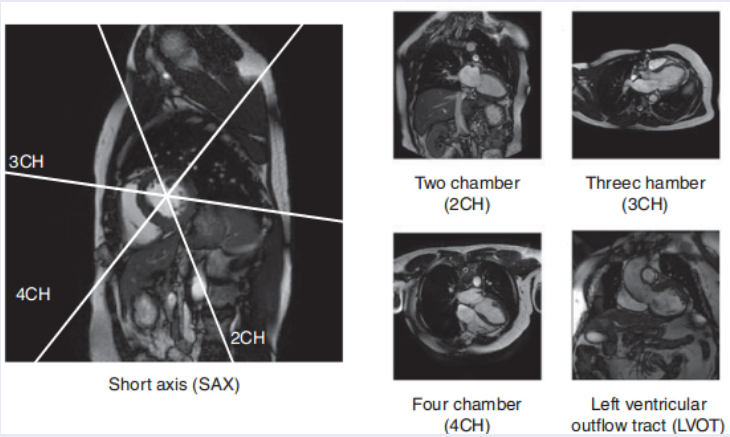
Motivation

- Cardiovascular diseases are leading causes of death around the world, more than 17,9 millions of deaths
- Lately the number of deaths have been incremented



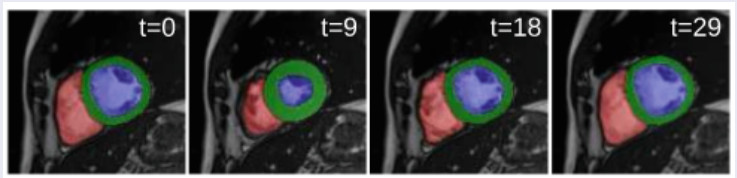
State of the art

J. Margeta *et al*,"*Fine-tuned convolutional neural networks for cardiac MRI acquisition plane recognition*"



- Predict chambers regarding acquisition views.
- Limited to global cine-MRI modeling.

F. Isensee *et al*, "*Automatic cardiac disease assessment on cine-MRI via time-series segmentation and domain specific features*"



- Depend on the segmentation task of ventricles.
- Lost motion information into the analysis.

Proposed method

Kinematics

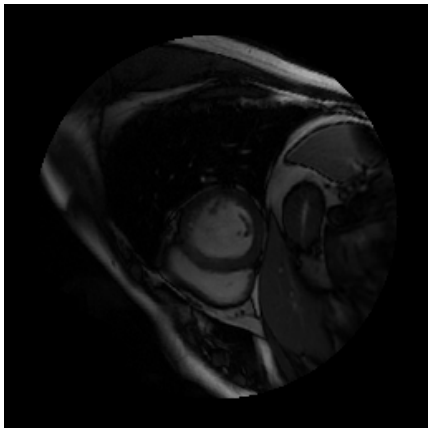


Fig 1. Cine-MRI Heart

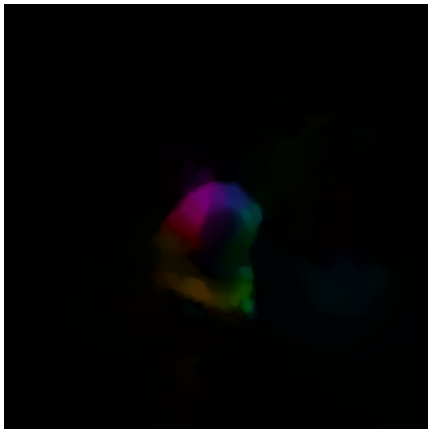


Fig 2. Optical Flow

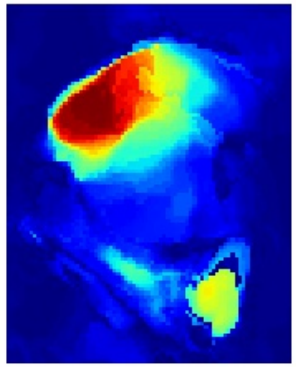


Fig 3. Normal Aceleration

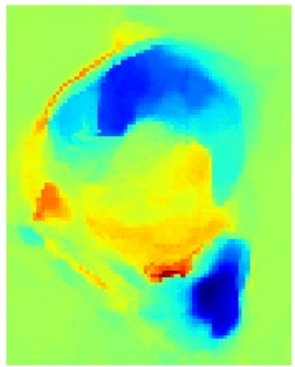


Fig 4. Tangential Aceleration

Metodologia

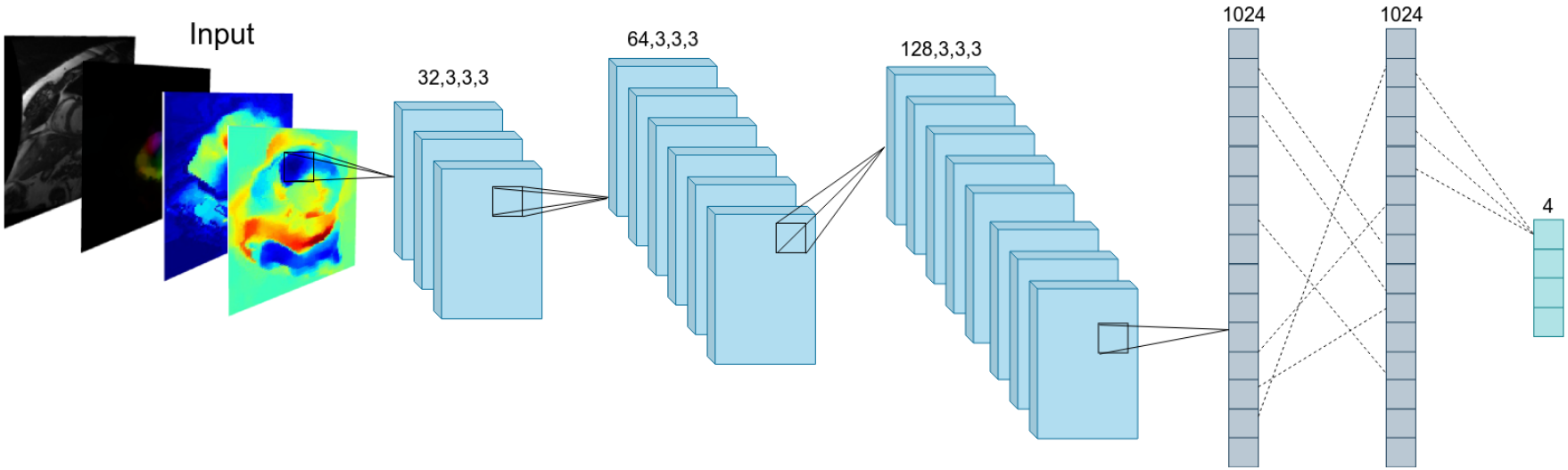
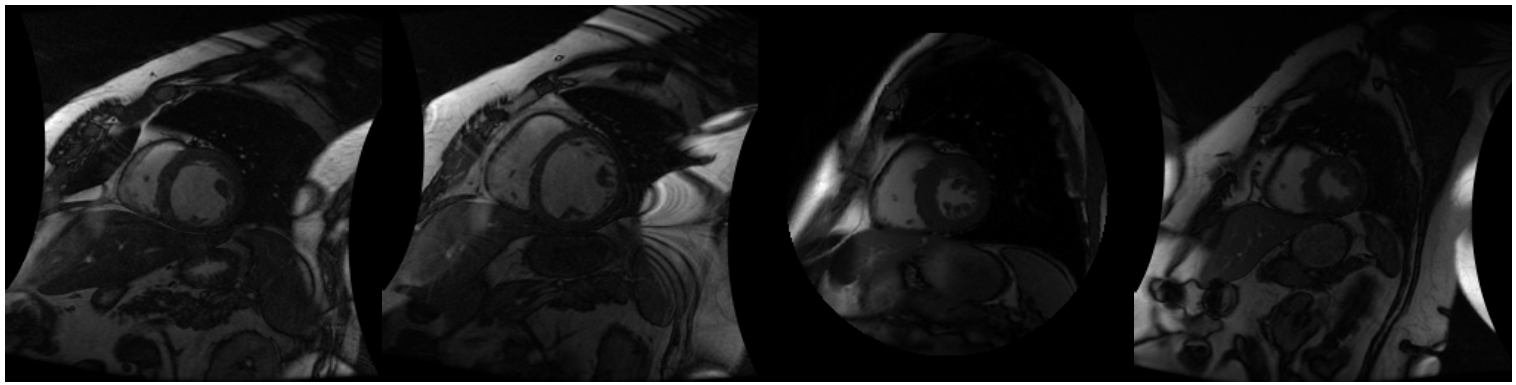


Fig 5. Arquitecture of Conv3D

Evaluation and results

Dataset

The dataset used in this approach was the Cardiac cine-MRI, proposed in a MICCAI challenge called SunnyBrook



- 45 patients (32 males and 13 women)
- 4 pathologies (HF-I, HF-NI, HYP, N)
- 256 x 256

Results of Binary Classifier

Cardiac Disease	**Accuracy**	**F1**
HF- I vs HF	60.87	64.00
HF-I vs HYP	47.82	50.00
HF-I vs N	30.00	22.22
HF vs HYP	26.17	26.08
HF vs N	33.33	22.22
HYP vs N	71.43	72.73
AVERAGE	44.94	42.88

Table 1. Binary classification to AN Kinematic

Results of Multi-class Classifier

Cardiac Disease	Accuracy (%)	F1-Score (%)
PPM	34.09	33.78
NA	27.27	25.90
TA	31.82	30.76

Table 2. Multi-class classifier with kinematics.

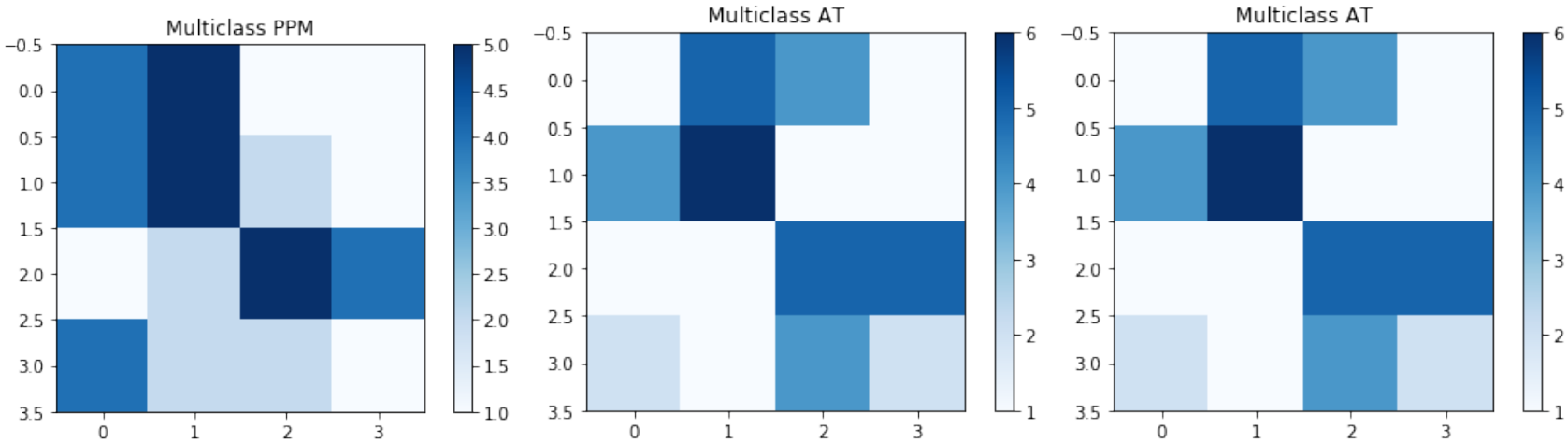


Fig 6. Confusion matrix PPM, NA and TA.