Cardiac pathology prediction according to convolutional methods with kinematic features

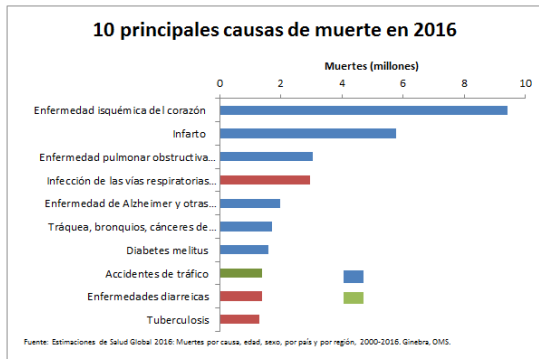Alejandra Moreno Tarazona & Fabio Martinez Carrillo

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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

10 principales causas de muerte en 2016

Muertes (millones)

Enfermedad isquémica del corazón
Infarto
Enfermedad pulmonar obstructiva...
Infección de las vías respiratorias...
Enfermedad de Alzheimer y otras...
Tráquea, bronquios, cánceres de...
Diabetes mellitus
Accidentes de tráfico
Enfermedades diarreicas
Tuberculosis

Fuente: Estimaciones de Salud Global 2016: Muertes por causa, edad, sexo, por país y por región, 2000-2016. Ginebra, OMS.

State of the art

J. Margeta *et al*, "*Fine-tuned convolutional neural networks for cardiac MRI acquisition plane recognition*"
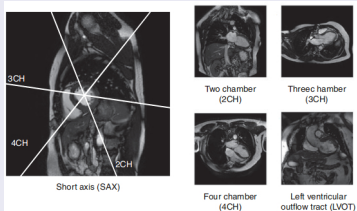
- Predict chambers regarding acquisition views.
- Limited to global cine-MRI modeling.

F. Isensee *et al*, "*Automatic cardiac disease assessment on cine-MRI via time-series segmentation and domain specific features*"
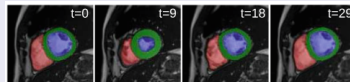
- Depend on the segmentation task of ventricles.
- Lost motion information into the analysis.

Proposed method

Fig 1. Cine-MRI Heart

Fig 3. Normal Aceleration

Fig 2. Optical Flow

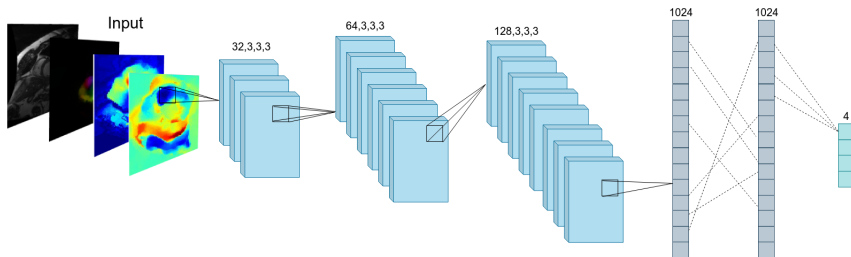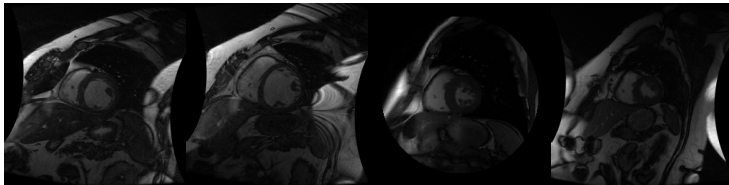**Fig 4**. Tangential Aceleration

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

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

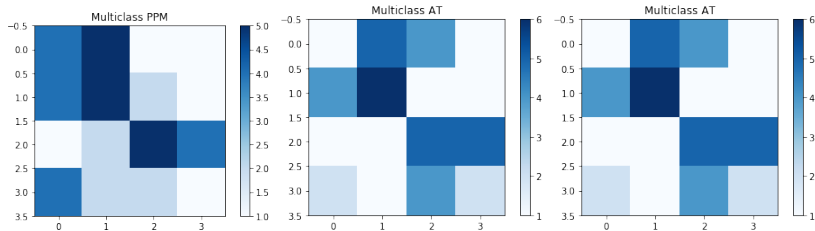| Cardiac Disease	Accuracy (%)	F1-Score (%)
PPM	34.09	33.78
NA	27.27	25.90
TA	31.82	30.76

Table 2. Multi-class classifier with kinematics.

Fig 6. Confusion matrix PPM, NA and TA.

- https://github.com/AlejandraM97/VISION-CODE/tree/master