



**HAL**  
open science

# The Study of Hypertensive Disorders of Pregnancy Using Doppler Ultrasound Fetal Information

Rayan Chaaban, Walaa Issa, Jean-Marc Girault, Amira J. Zaylaa

► **To cite this version:**

Rayan Chaaban, Walaa Issa, Jean-Marc Girault, Amira J. Zaylaa. The Study of Hypertensive Disorders of Pregnancy Using Doppler Ultrasound Fetal Information. Annual Engineering Exhibition, 2018, May 2018, Beirut, Lebanon. inserm-01800368

**HAL Id: inserm-01800368**

**<https://inserm.hal.science/inserm-01800368>**

Submitted on 25 May 2018

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



# Department of Biomedical Engineering

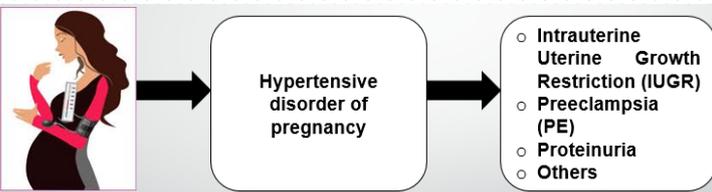
## The Study of Hypertensive Disorders of Pregnancy Using Doppler Ultrasound Fetal Information



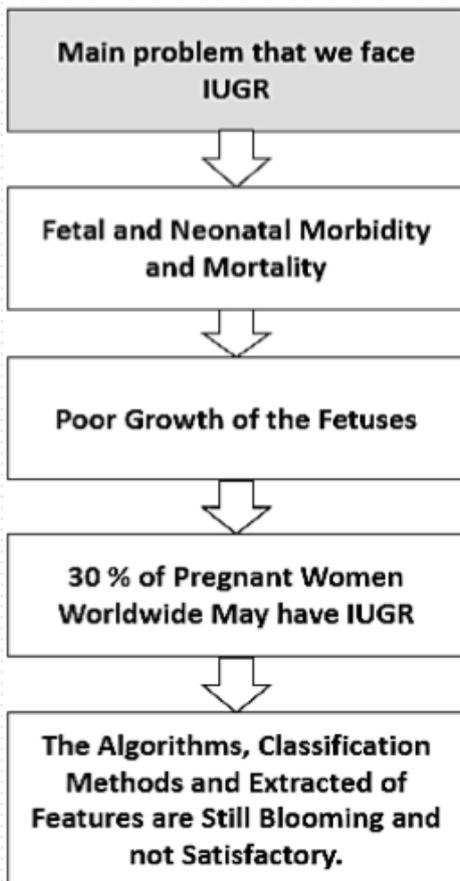
Rayan Chaaban, Walaa Issa, Jean-Marc Girault and Amira J. Zaylaa\*  
\*Corresponding Author

### Introduction

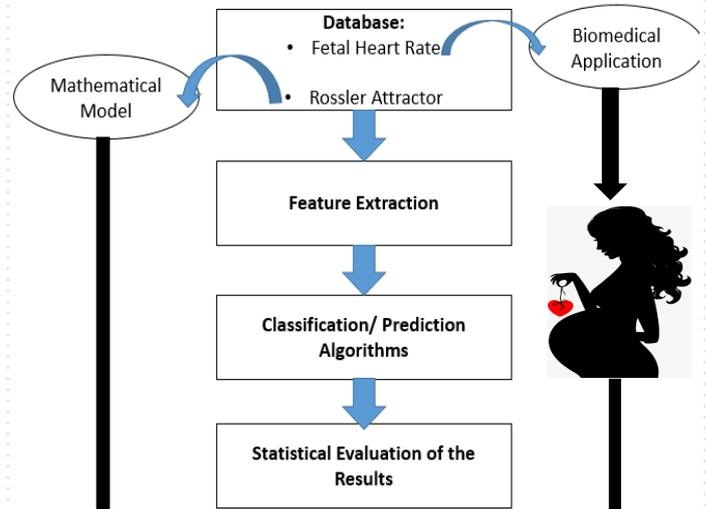
- Hypertension of pregnancy is a critical health issue for pregnant women, and consequently their infants.
- One of the major signs and consequences of HDP is the IUGR, also known as Fetal Growth Restriction (FGR).
- IUGR refers to the poor growth of the fetus while in the mother's womb during pregnancy.



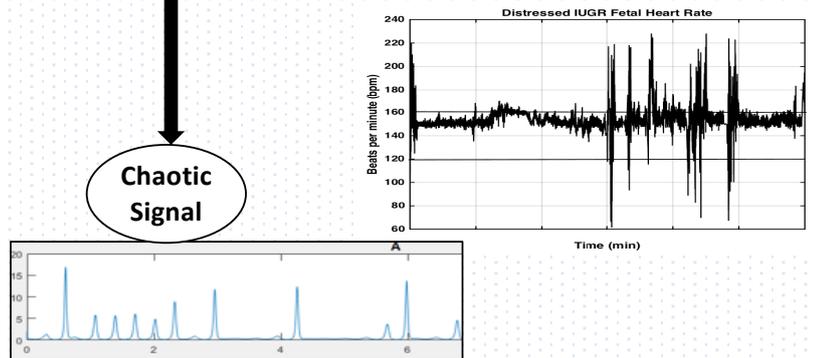
### Problematic and Objectives



### Methodology



### Testing & Results



Combination Between Features	Algorithms	Sensitivity	Specificity	Accuracy	Precision
I. [fuzzyentropy; condition; kurtosis]	K-means	100	37.5000	64.2857	54.5455
	K Nearest Neighbors (KNN)	83.3333	100	87.5000	100
	Support Vector Machine (SVM)	83.3333	66.6667	77.7778	83.3333
	Fuzzy C Means (FCM)	100	33.3333	60	50
II. [Costa Entropy; Fuzzy Entropy; Permutation Entropy]	K-means	100	37.5	64.28	60
	K Nearest Neighbors (KNN)	83.3333	100	87.05	100
	Support Vector Machine (SVM)	83.3333	66.66	77	83.3333
	Fuzzy C Means (FCM)	100	37.5	64.28	50
III. [multiscale_permEntropy; permutation entropy]	K-means	100	50	75	80
	K Nearest Neighbors (KNN)	100	100	100	100
	Support Vector Machine (SVM)	100	66.6667	85.7143	66.6667
	Fuzzy C Means (FCM)	100	33.3333	60	50
IV. [multiscale_permEntropy; condition; kurtosis]	K-means	100	42.8571	69.2308	60
	K Nearest Neighbors (KNN)	66.6667	100	71.4286	100
	Support Vector Machine (SVM)	83.3333	66.6667	77.7778	83.3333
	Fuzzy C Means (FCM)	100	33.3333	60	50

### Conclusion

Two types of signals (periodic and chaotic Rossler signals) modeled healthy and IUGR signals of the pregnant women. New combinations of features aided in an advanced classification of modeled signals and thus chaotic signal detection.