XMM variable source classification

Instrument

	Paper	Our work
Obs	XMM Newton	CHANDRA
Instrument	EPIC-PN	ACIS
Resolution	3.3 arcsec	1 arcsec
Energy Bands	0.2 - 0.5 keV 0.5 - 1.0 keV 1.0 - 2.0 keV 2.0 - 4.5 keV 4.5 - 12.0 keV	broad band (b) : 0.5-7.0 keV ultrasoft (u): 0.2-0.5 keV soft (s) : 0.5-1.2 keV medium (m) : 1.2-2.0 keV hard (h) : 2.0-7.0 keV

Sources

	Paper	Our work
Source of interest	time variable sources	Globular cluster sources
Source distribution	All sky	globular clusters
Target class	AGN , SSS , ULX , GRB , XRB , CV , star	NS-LMXRB , BH-LMXRB, CV , Pulsars
Training data preparation	They have first identified all the time varaible x-ray sources in 2XMMi catalogue , then cross-matched to find the nature of as many source as possible , and taken those classes as the target classes.	Based on litereature review , we have identified our target class - and then identified sources belonging to those class in Chandra catalogue.

Features

In the paper , they are extracting feature table from the light curve on their own insted of directly taking it from XMM catalogue. Also they are using multi-wavelength (radio / optical / NIR) magnitude values.

We are taking the features available in Chandra source catalogue.

Paper

- Time Series features
    - preiodicity
    - Power-law decay of lightcurve
    - Number of flares
    - Statistical features
- Contextual features
    - Hardness ratio
    - Optical / NIR cross match
    - Radio cross maatch
    - Association with galaxies
    - Galactic coordinates

Our work

- Aperture photometry
  - Photon flux in different bands
  - energy flux - photon flux in a given band* avg band energy
- Spectral Hardness ratio
- Model spectral fits
  - Black body
  - Powerlaw
- Temproal varability
  - Intra-observation Gregory-Loredo varaibaility
  - Intra-observation Kolmogonorov-Smironov test variabilityFeature importance

Classifier / Result

Paper	Our work
Random Forest	Random Forest
SMOTE algorithm for class imbalance problem	No sognificant class imbalance
Classifying observations and not sources	Classifying observation and not soures
GINI Impurity based Feaure importance as give by Random Forest , no class-wise feature importance	Class-wise feature importance
Report class membership probability for observations	Ambiguous class for prediction below a certain threshold