

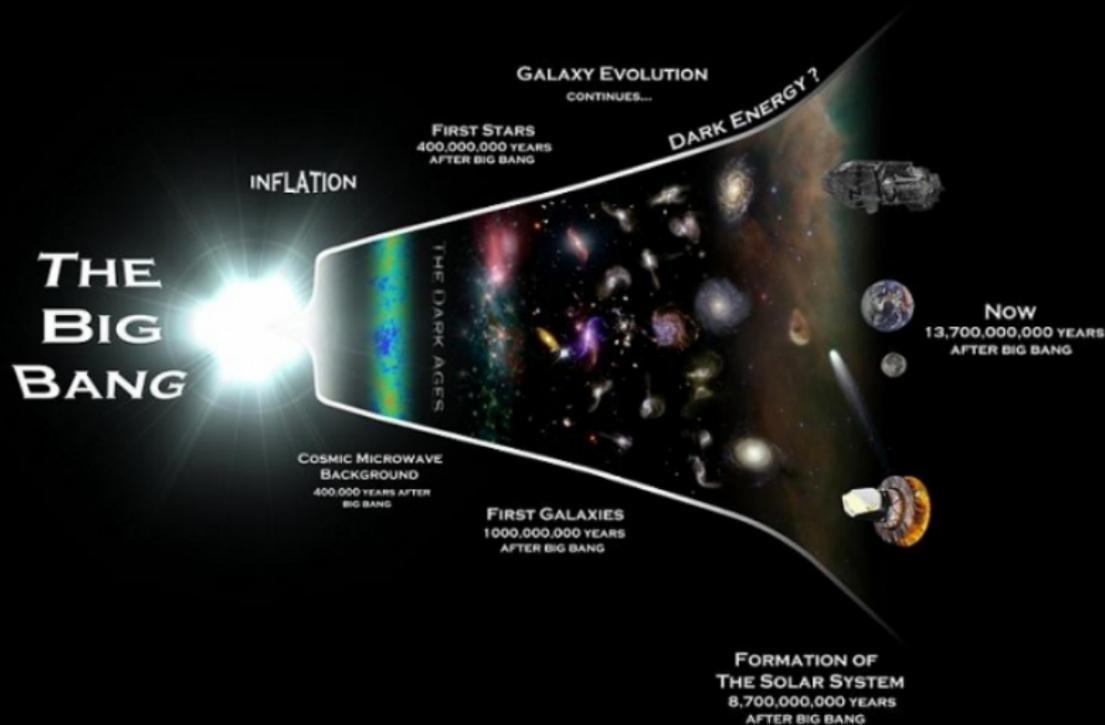
# Cheap deep learning for photometric Supernova classification

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# Cosmic evolution and accelerated expansion

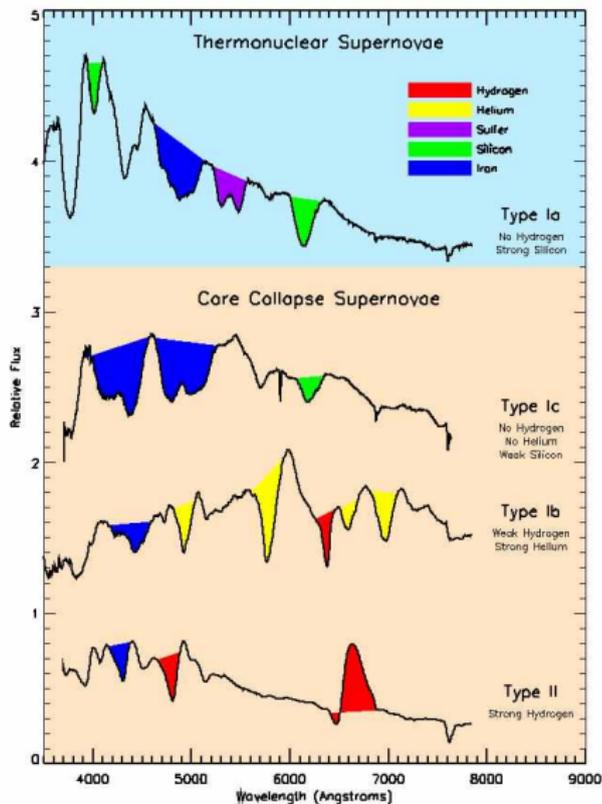


# Artist impression of Supernova explosion

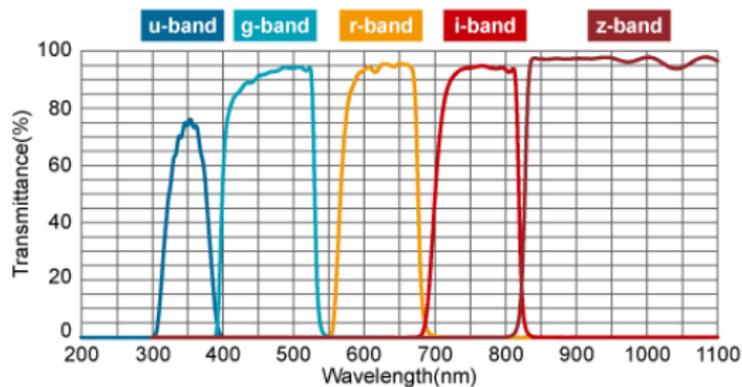
Thermonuclear explosion or core collapse



# Spectroscopic Supernova classification

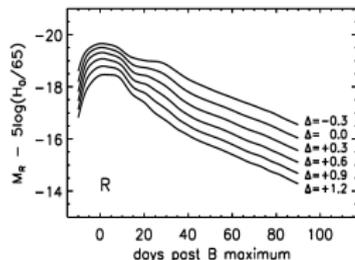


# Photometric Supernova classification

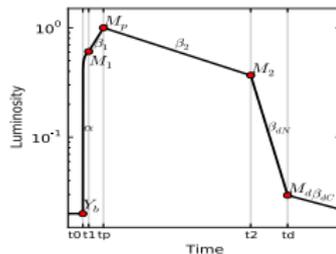


# Photometric Supernova classification

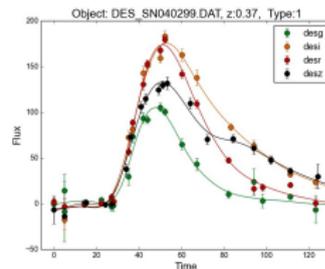
- Photometric Supernova classification by machine learning (Lochner, McEwen, Peiris, Lahav & Winter 2016)
- Go beyond single techniques to study classes.



(a) Templates



(b) Generic parameterisations



(c) Wavelets (non-parametric)

Figure: Feature selection classes (in order of increasing model independence)

- Integrate physics into machine learning (scale and dilation invariance).
- Building on foundations of deep learning.

# Importance of representative training data

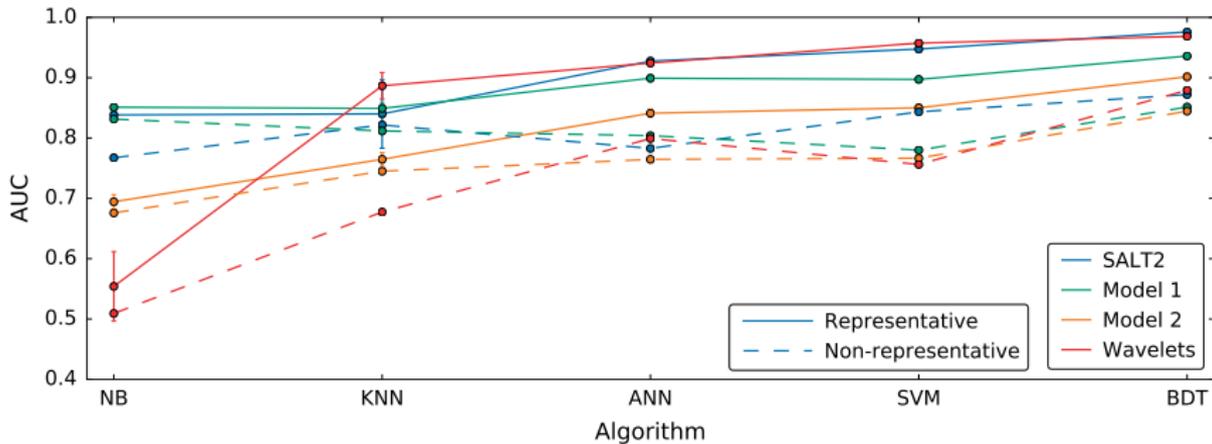


Figure: Area under ROC curve with and without representative training

## Representativeness of training data

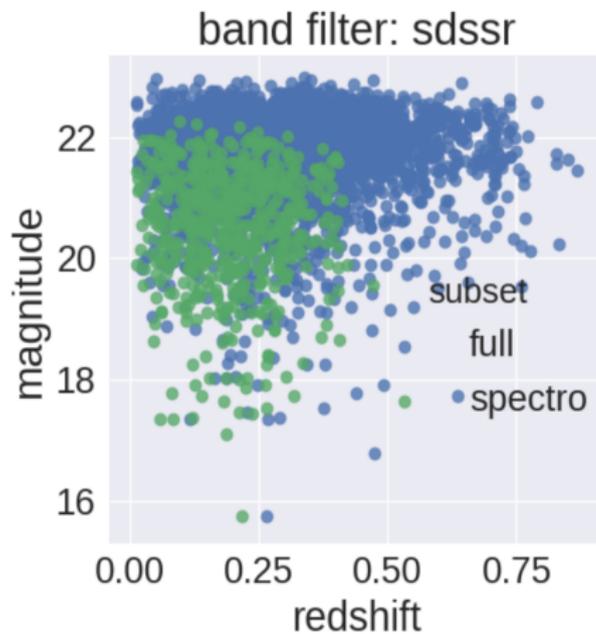


Figure: Training (green) vs test (blue) data

# Data augmentation

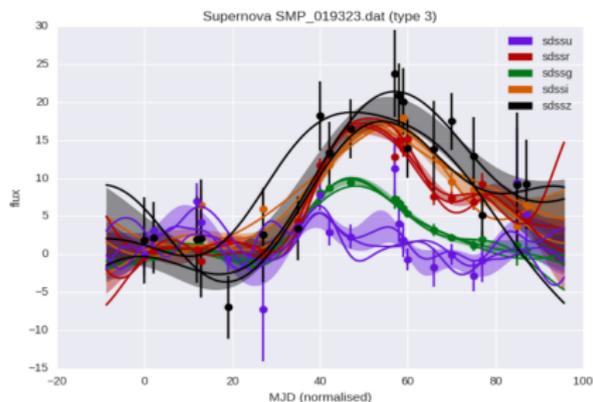
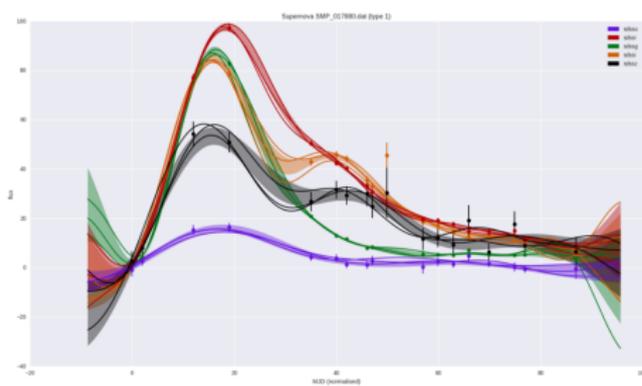


Figure: Resampling Gaussian process. [Credit: Robert Schuhmann]



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