* [**Sloan Digital Sky Survey -- DR7**](https://classic.sdss.org/dr7/)
  + Metadata
    - Approximately **357 million** unique celestial objects (ChatGPT)
      * Each image is **2048 x 1489** (from DR9)
      * Without bands it seems to follow the RGB channel standard
      * Bands: **u**, **g**, **r**, **i**, **z**
        + **1** channel
    - Spectrum: infrared (DR18)
  + [A brief review of contrastive learning applied to astrophysics](https://academic.oup.com/rasti/article/2/1/441/7238495)
    - Morphology Classification - Wei et al. (2022)
    - Predict spectra from images (combined with multimodal conditional diffusion models) - Chen et al (2020a)
    - Domain Adaptation and Clustering - Chen et al (2020a)
  + [Classification of Astronomical Bodies by Efficient Layer Fine-Tuning of Deep Neural Networks](https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9672430&casa_token=1ajTnZylzWcAAAAA:r2B7Crg6drIdJ-lTmZK0DWnMWWVOf2z509EfUNVJ_nWgpPHJmlIYD5ovuW8MF_RZz6w4Rxxm)
    - Preprocessing
      * Resized from 2048 x 2048 x 3 to 512 x 512 x 3 to reduce number of training parameters
      * Feature Selection
        + Uses images
    - Downstream
      * classification
  + [Deep Learning Approach to Photometric Redshift Estimation](https://arxiv.org/pdf/2310.16304.pdf)
    - Preprocessing
      * Sigma-clipping on the redshift values (3 standard deviation)
      * Feature selection
        + 5 wavelengths of light: *u, g*, *r*, *i*, and *z*
        + Removed redshift values less than 0
    - Downstream
      * Redshift predictions
  + [Fanaroff-Riley classification of radio galaxies using group-equivariant convolutional neural networks](https://arxiv.org/pdf/2102.08252.pdf)
    - Preprocessing
      * Some labeled objects were excluded
        + 40 objected denoted as 3 - unclassifiable
        + 28 objects which had an angular extent greater than selected image size
        + 4 objects with structure that was found to overlap the edge of the sky area
        + Single object in 3-digit category 103
      * image pixels set to zero if value is below a threshold of three times the local rms noise
      * Clipped to about 150 x 150 pixels
      * All pixels outside a square central region with extent equal to the largest angular size of the radio galaxy are set to zero
      * Normalized
      * Feature Selection
        + Images
    - Downstream
      * Classification of astronomical objects
  + [Galaxy Morphological Classification with Efficient Vision Transformer](https://arxiv.org/pdf/2110.01024.pdf)
    - Preprocessing
      * Downloaded from Kaggle
        + Size is **424 x 424 x 3** with **g**, **r**, **i** filters from SDSS
      * Apply thresholds on series of voting questions answered by participants in GZ2
      * 64% training, 16% validation, and 20% testing
      * Crop images into 224 x 224 x 3
      * Flipping and rotating data augmentation techniques
      * Normalize by mean ([.094, .0815, .063]) and standard deviation ([.1303, .11, .0913])
      * Feature Selection
        + Images with *g*, *r*, and *I* filters
    - Downstream
      * Galaxy morphological classification
  + [Photometric redshifts for Quasars in multi band surveys](https://arxiv.org/pdf/1305.5641.pdf)
    - Preprocessing
      * Used four datasets SDSS, GALEX, UKIDSS, and WISE
      * Selected quasars which had reliable measure of the spectroscopic redshifts
      * Used maximum radius r = 1.5” to associate the optical quasars to counterparts in each of the three catalogs
      * Feature selection
        + 15 bands from various datasets
        + 43 different features
        + Best combination of features

Five SDSS psfMag

Two isophotal magnitudes of GALEX

Four HallMag for UKIDSS

Four magnitudes for WISE

* + - Downstream
      * Evaluating photometric redshifts for quasars
  + [Self-Supervised Representation learning for Astronomical Images](https://arxiv.org/pdf/2012.13083.pdf)
    - Preprocessing
      * Galactic extinction
        + Artificial sampling by sampling a reddening value from and applying corresponding per-channel extinction according to photometric calibration from Schlafly, D. & Finkbeiner
      * Point spread function (PSF)
        + PSF augmentation using Aaussian smoothing
      * Rotation
        + Random rotation from distribution
      * Random jitter & crop
        + Jitter center of image along respective axis
      * Gaussian noise
        + Add Gaussian noise for each color channel
      * Feature Selection
        + Used images for morphology classification
        + for redshift estimation
    - Downstream
      * Similarity search
      * Galaxy morphologies
      * Redshift predictions
      * Anomaly detection
      * Strong lens finding
      * Low brightness gals
  + [Towards Galaxy Foundation Models with Hybrid Contrastive Learning](https://arxiv.org/pdf/2206.11927.pdf)
    - Preprocessing (seems to be all they did)
      * Images grouped into surveys according to telescope used and operating conditions
      * Volunteers labeled images
    - Downstream
      * Purely-contrastive approaches in general (paper is not super clear)
    - Feature Selection]
      * Target galaxies
        + Angular resolution (how sharp sources appear)
        + Depth (how bright sources must be to distinguish themselves from the background.
  + [Photometric Redshifts from SDSS Images with an Interpretable Deep Capsule Network](https://arxiv.org/pdf/2112.03939.pdf)
    - *Note: uses a subsection of the SDSS that Amirezza uses*
    - Preprocessing
      * Pre-processed images and spectroscopic redshifts used by Pasquet et al
        + Stacked and re-sampled images to common 64 x 64 x 5 pixel grid
        + Background subtracted and photometrically calibrated with same zero point
      * Feature Selection
        + From Pasquet et al
        + De-reddened r band petrosian magnitudes
        + ugriz
    - Downstream
      * Photometric redshift estimation
    - Metrics
      * Hinge loss
        + Tj represents class labels
        + M+ = .9
        + M- = .1
        + Lambda = .5
      * Output of decoder network for sum of squared errors
      * Squared error for redshift regression network
      * For margin loss and total squared reconstruction (weighted)
      * Same as above except with photo-z loss
      * Photo-z evaluation metrics