



LIS

LABORATOIRE
D'INFORMATIQUE
& SYSTÈMES

UMR 7020 

Encode physics information into your models

BERTHELOT Loris

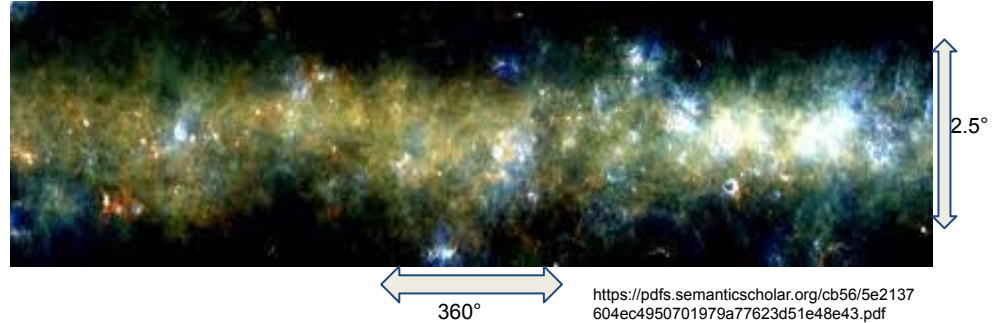


LAM
LABORATOIRE D'ASTROPHYSIQUE
DE MARSEILLE

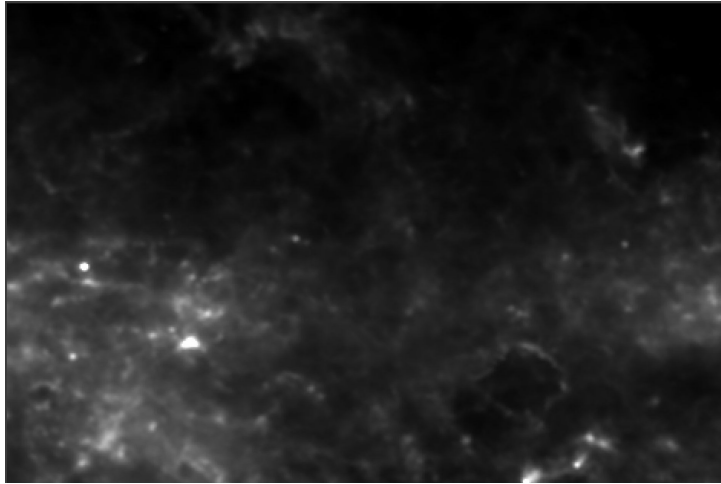


Hi-GAL dataset

- H2 Column density
- 1 map of 1800 x 11400 pixels
- Value from $1e20$ to $1e24$



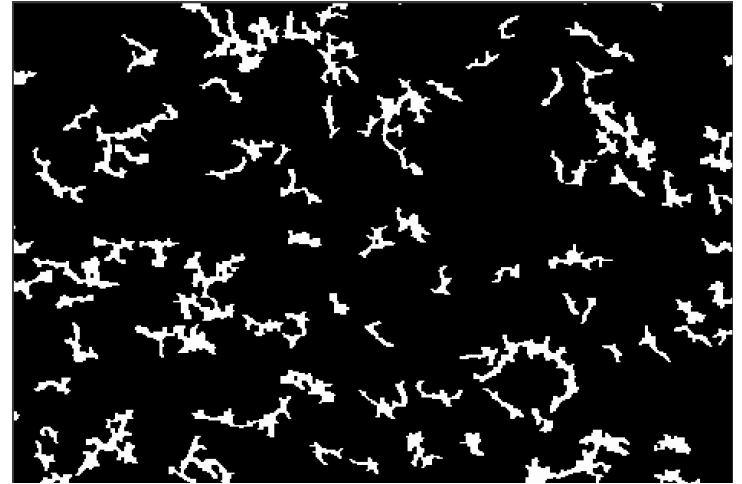
Objective: segmentation semantic



H2 column density: Hi-GAL dataset, Molinari+ 2010



Machine
learning
UNet



Zavagno+2023

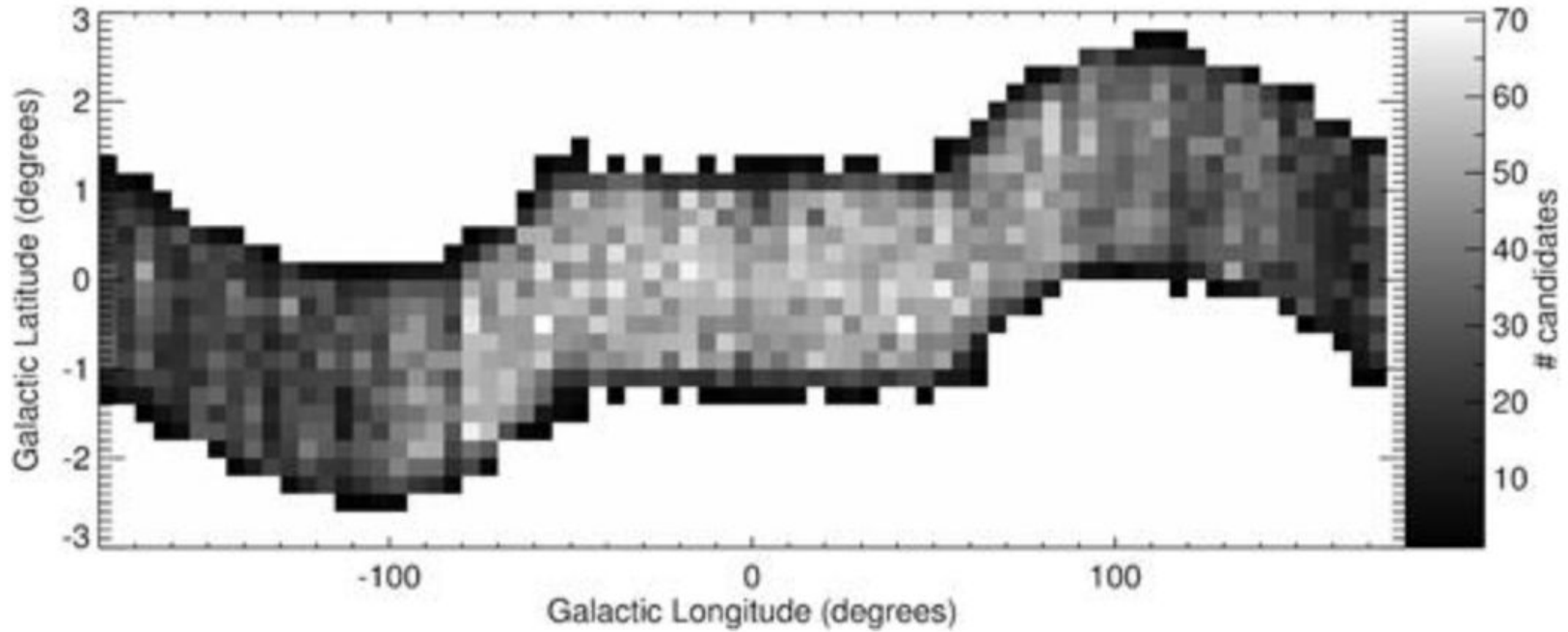
3 different ways of doing PINN

- Observational bias: Data augmentation
- Inductive bias: Architecture
- Learning bias: PDE

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- Inductive bias: Architecture ← PE-UNet
- Learning bias: PDE

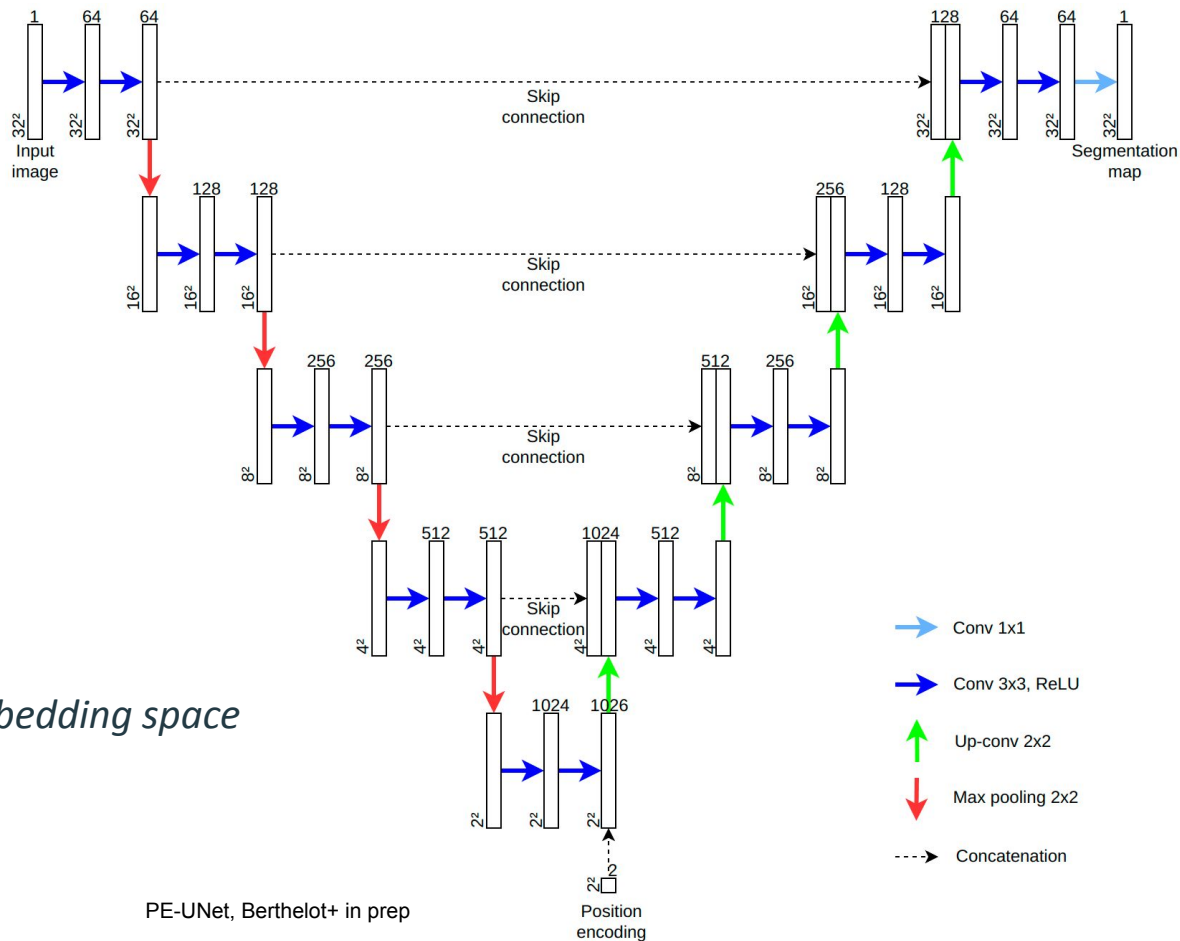
Filament distribution within the galaxy



Filament distribution along the galactic plane, Schisano+2020

PE-UNet

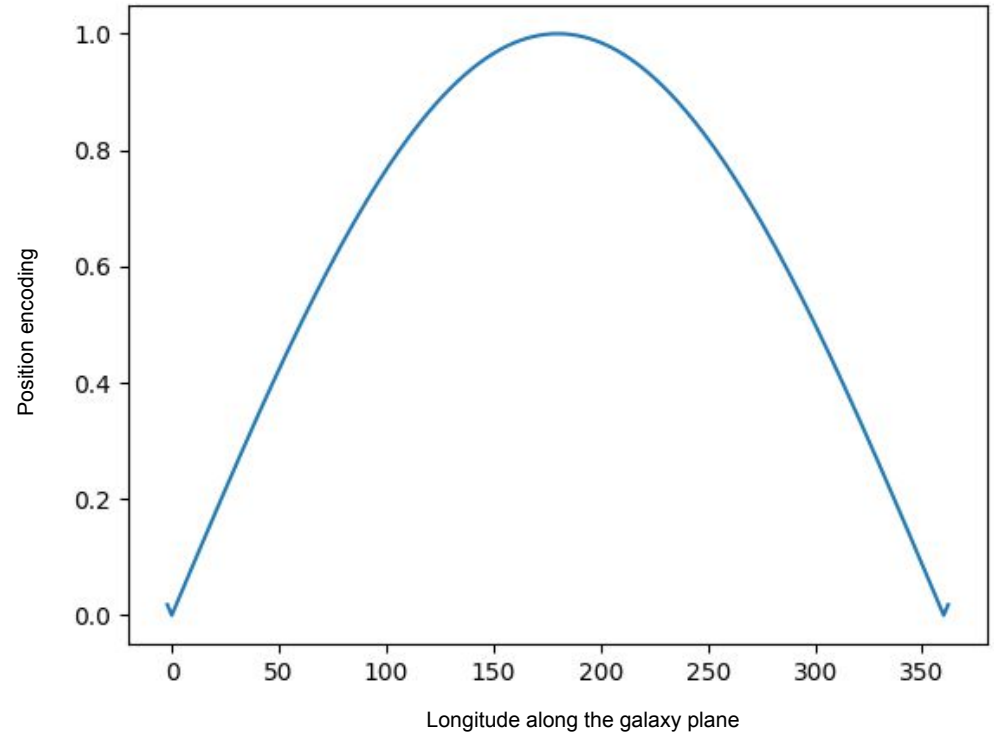
- Give the position information
- Encode it into the *embedding space*



PE-UNet, Berthelot+ in prep

Position encoding

- Formula: $pe(x) = \left| \cos\left(\frac{x}{2}\right) \right|$
- Position encoding properties:
 - Symmetrical
 - Periodical
 - Normed between 0 and 1

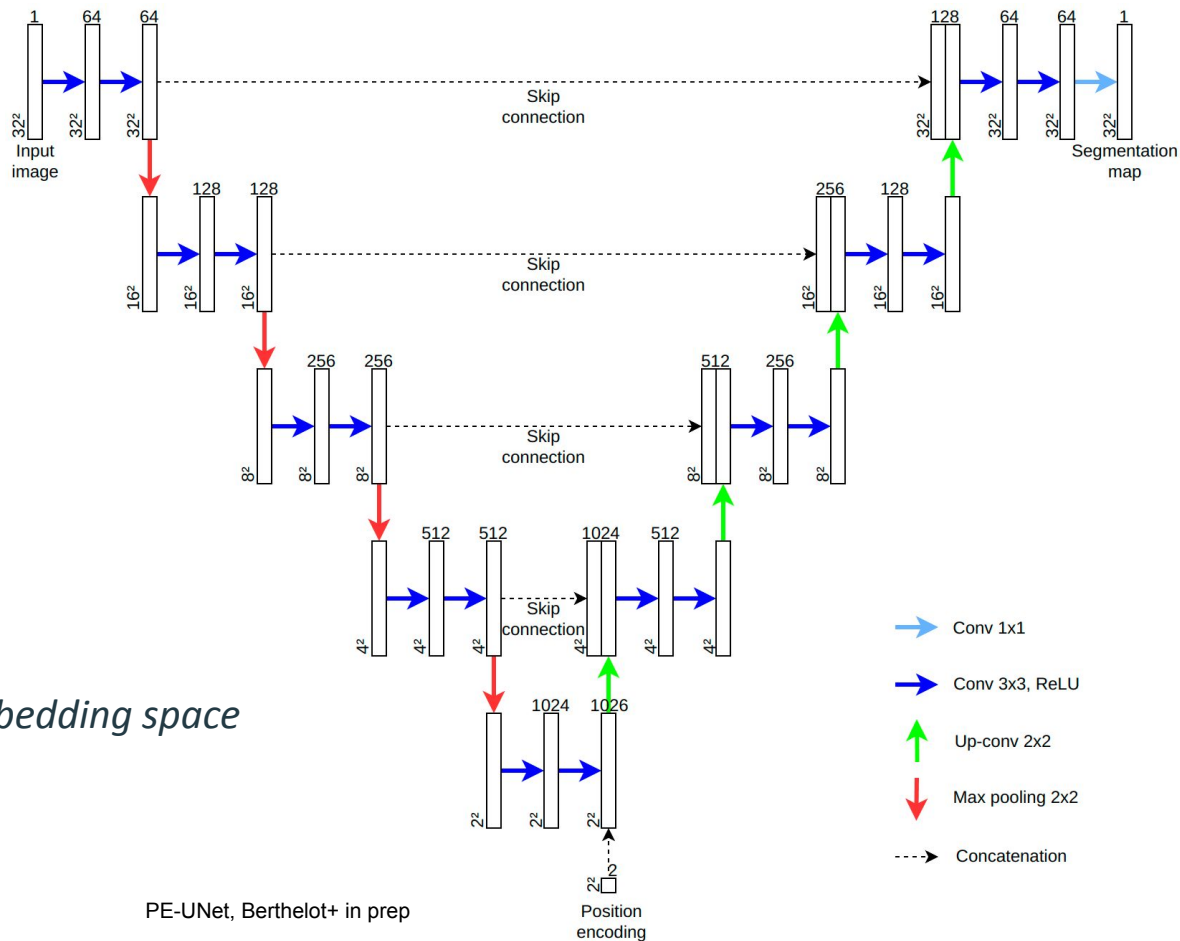


Position encoding, Berthelot+ in prep

PE-UNet

- Give the ANY physics information

- Encode it into the *embedding space*



PE-UNet, Berthelot+ in prep



Thanks for your attention