Measuring the angular distribution of the cosmological parameters.

Martín de los Rios & Mariano Domínguez

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   - Supervised learning.
   - Machine Learning in physics.
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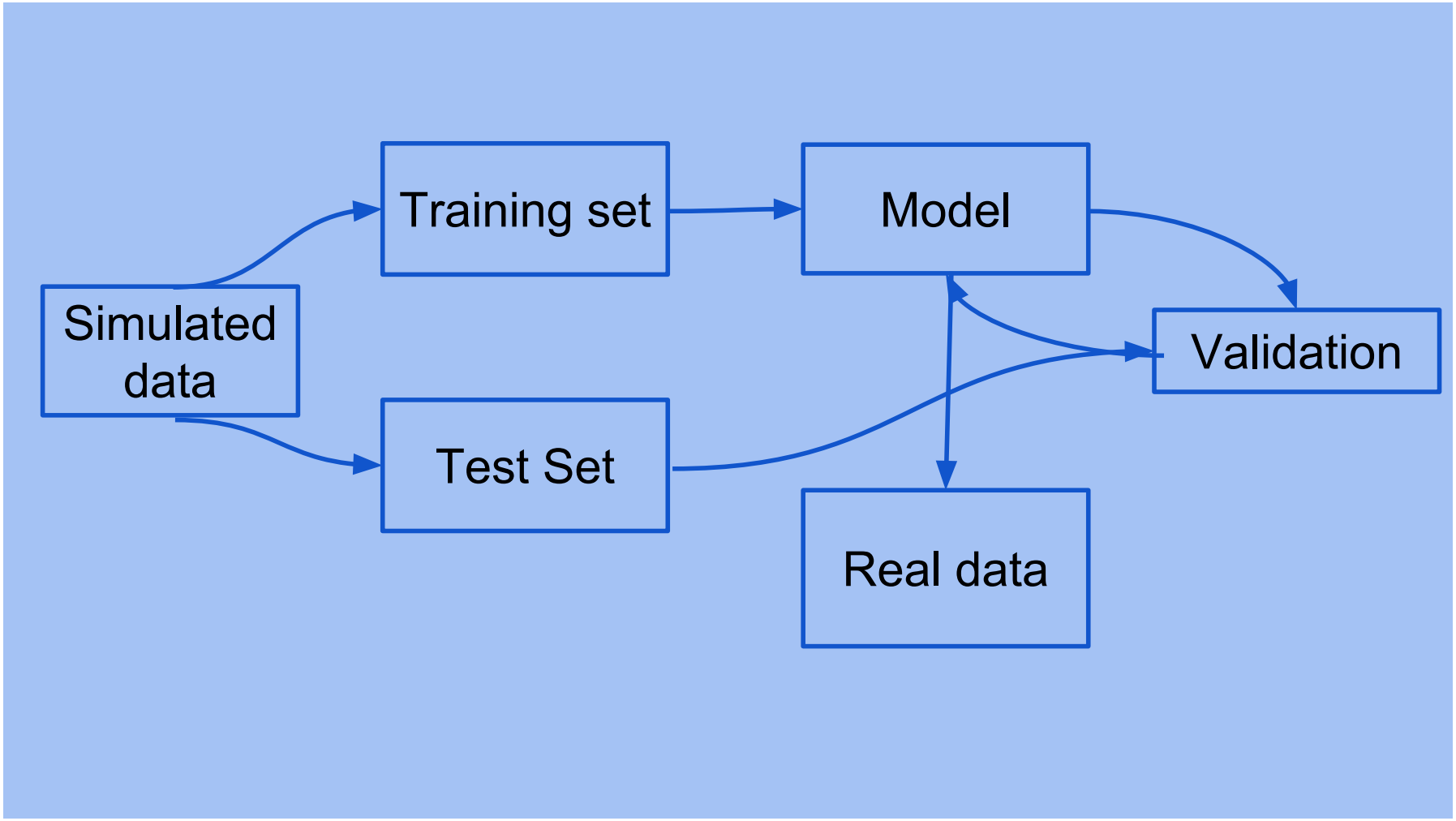
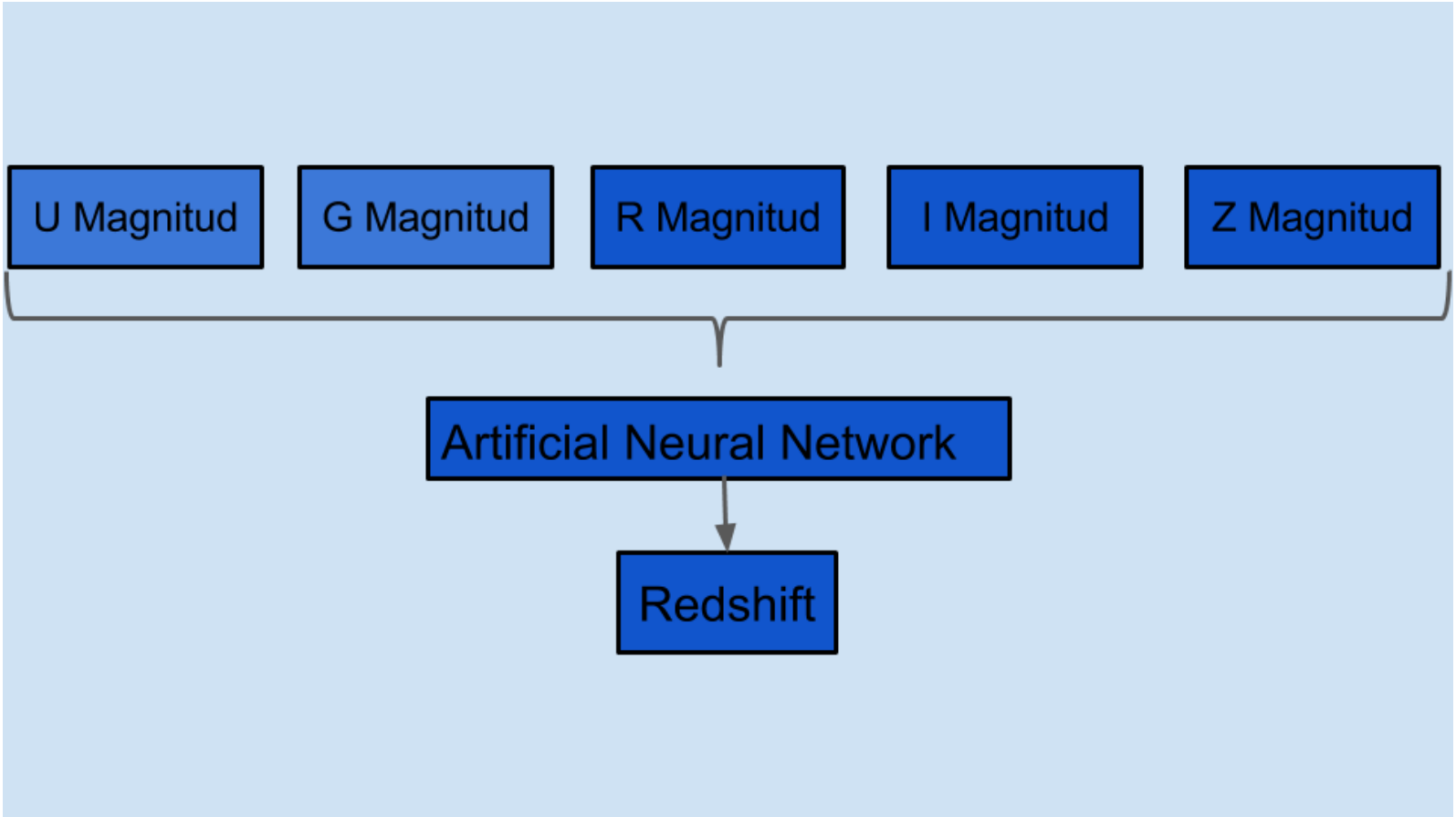
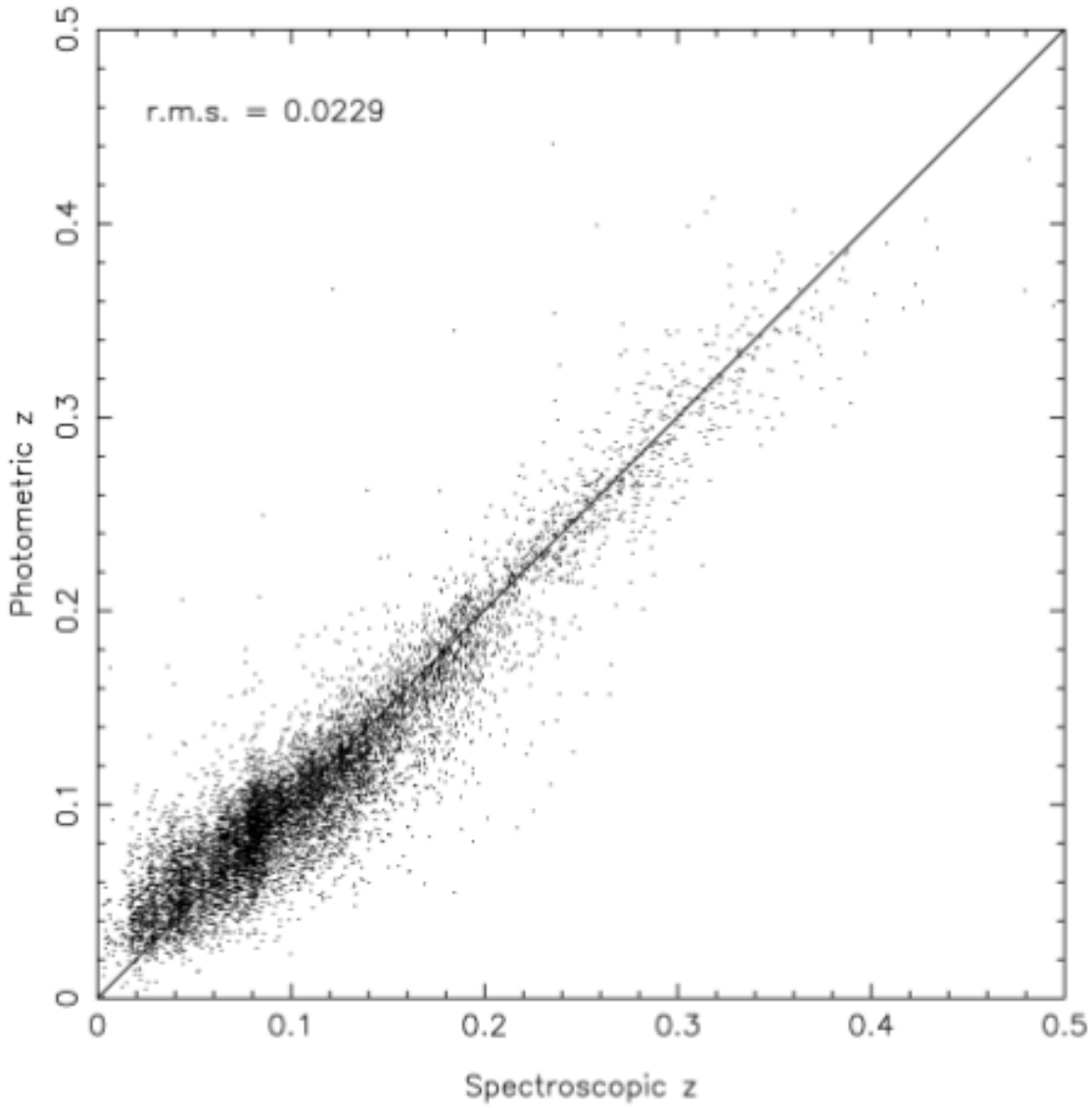
Supervised Learning.



Simple Example:ANNz

ANNz: Estimating photometric redshift using artificial neural network. Collister & Lahav 2003 (0311058)




r.m.s. = 0.0229
Photometric z
Spectroscopic z
0
0.1
0.2
0.3
0.4
0.5

https://arxiv.org/find

Buscar

1. arXiv:1703.06236 [pdf, other]

Discovering the Building Blocks of Atomic Systems using Machine Learning
Conrad W. Rosenbrock, Eric R. Homer, Gábor Csányi, Gus L. W. Hart
Comments: 8 pages, 4 figures, 1 table
Subjects: **Materials Science (cond-mat.mtrl-sci)**; Computational Physics (physics.comp-ph)

2. arXiv:1703.05402 [pdf, other]

Experimental Quantum Hamiltonian Learning
Jianwei Wang, Stefano Paesani, Raffaele Santagati, Sebastian Knauer, Antonio A. Gentile, Nathan Wiebe, Maurangelo Petruzzella, Jerem
Mark G. Thompson
Subjects: **Quantum Physics (quant-ph)**

3. arXiv:1703.05334 [pdf, other]

Many-body quantum state tomography with neural networks
Giacomo Torlai, Guglielmo Mazzola, Juan Carrasquilla, Matthias Troyer, Roger Melko, Giuseppe Carleo
Subjects: **Disordered Systems and Neural Networks (cond-mat.dis-nn)**; Quantum Gases (cond-mat.quant-gas); Computational Physics (physics.comp-ph); Quantum P

4. arXiv:1703.05210 [pdf, other]

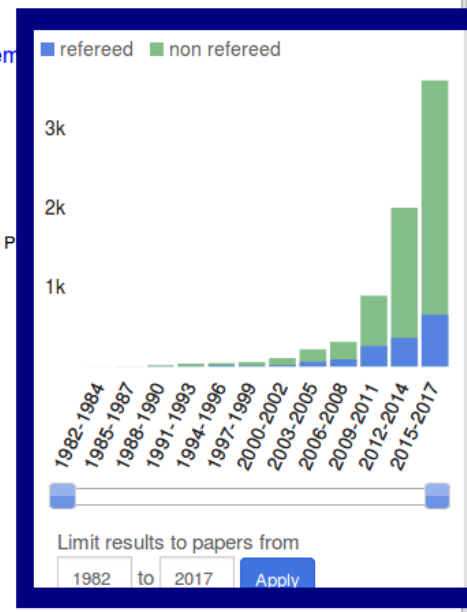
Neural Networks retrieving Boolean patterns in a sea of Gaussian ones
Elena Agliari, Adriano Barra, Chiara Longo, Daniele Tantari
Comments: 16 pages, 1 figure
Subjects: **Mathematical Physics (math-ph)**; Disordered Systems and Neural Networks (cond-mat.dis-nn)

5. arXiv:1703.05084 [pdf, ps, other]

Astrophysics and Big Data: Challenges, Methods, and Tools
Mauro Garofalo, Alessio Botta, Giorgio Ventre
Comments: 4 pages, 1 figures, proceedings of the IAU-325 symposium on Astroinformatics, Cambridge University press
Subjects: **Instrumentation and Methods for Astrophysics (astro-ph.IM)**

6. arXiv:1703.04351 [pdf, other]

Model-independent search for neutrino sources with the ANTARES neutrino telescope
A. Albert, M. André, M. Anghinolfi, G. Anton, M. Ardid, J.-J. Aubert, T. Avgitas, B. Baret, J. Barrios-Martí, S. Basa, V. Bertin, S. Biagi, R. Bormuth, S. Bourret, M.C. Bouwhuis, R. Bruijn, J.



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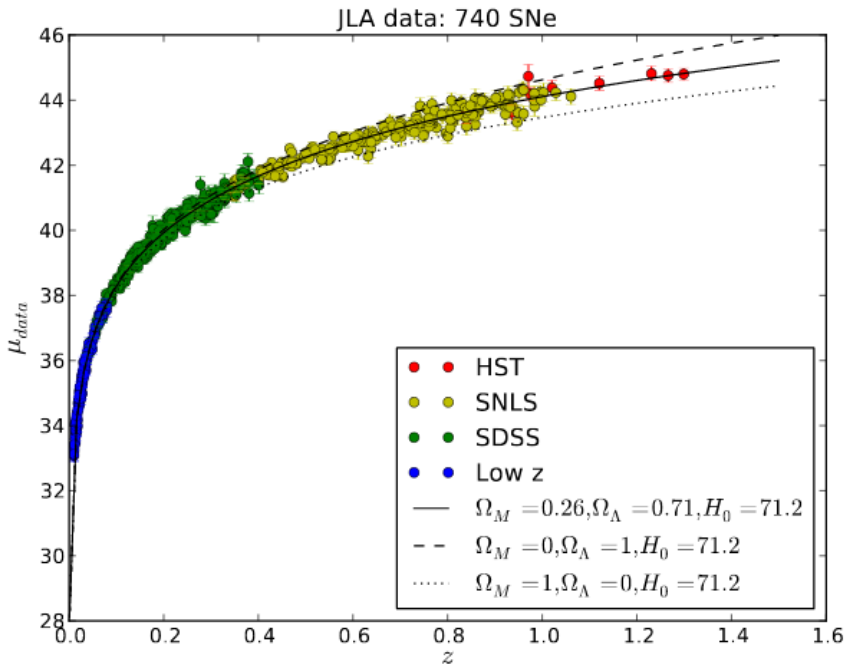
What are the cosmological parameters?

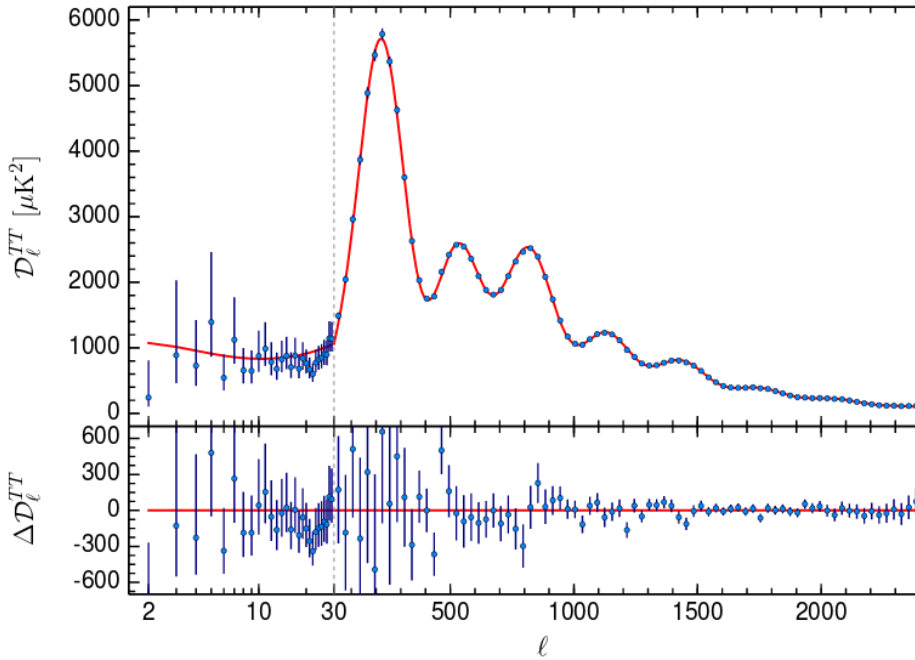
Homogeneous and isotropic Universe $\rightarrow$ FRW metric

$ds^2 = dt^2 - a^2(t)[\frac{dr^2}{1-kr^2} + r^2(d\theta^2 + sin^2\theta d\phi^2)]$

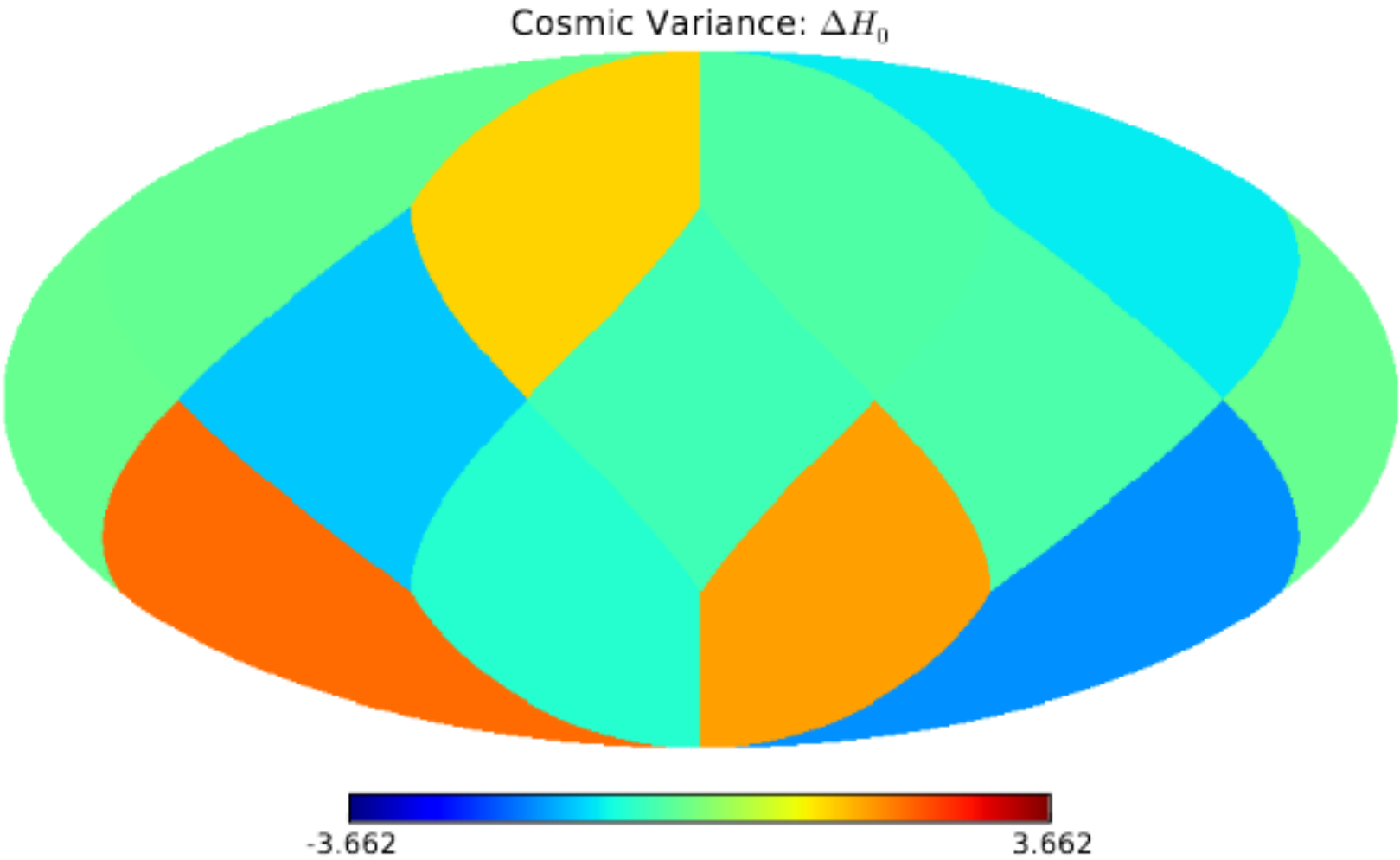
$(\frac{H}{H_0})^2 = \Omega_{rad} a^{-4} + \Omega_m a^{-3} + \Omega_\Lambda - Kc^2 a^{-2}$

How can we measure the cosmological parameters?





Carvalho & Marques 2015 (1512.07869) Planck Collaboration 2015 (1502.01589)



Carvalho & Marques (1512.07869)

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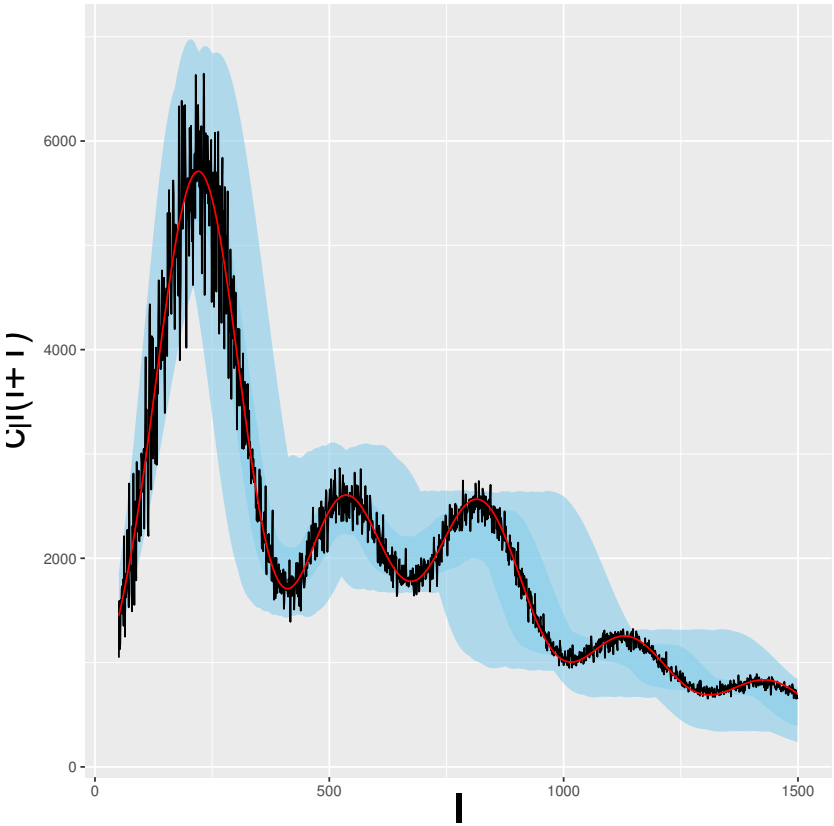
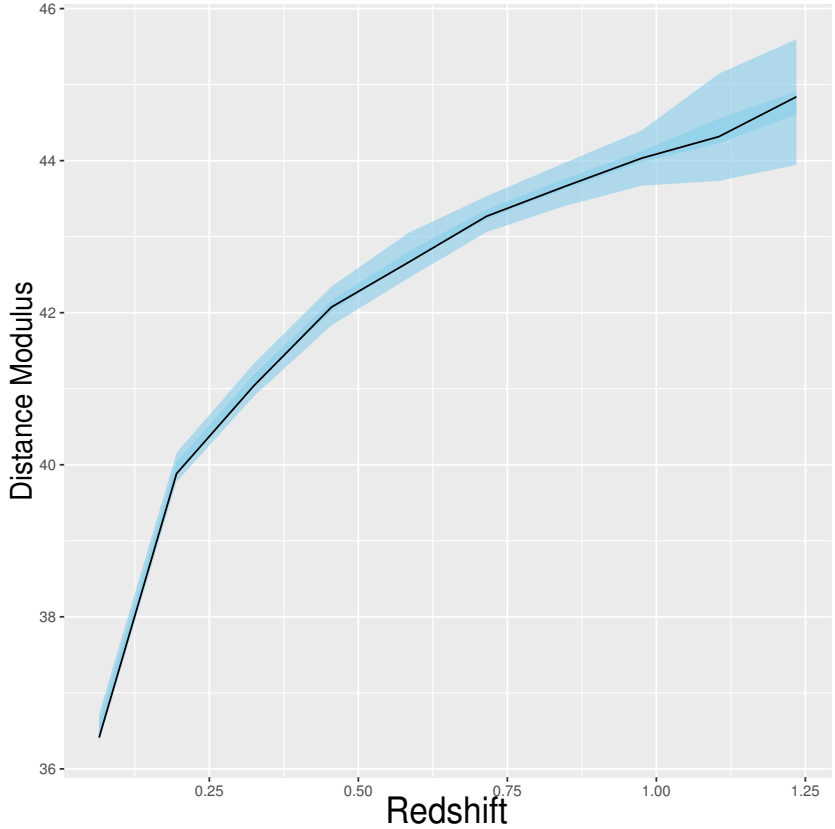
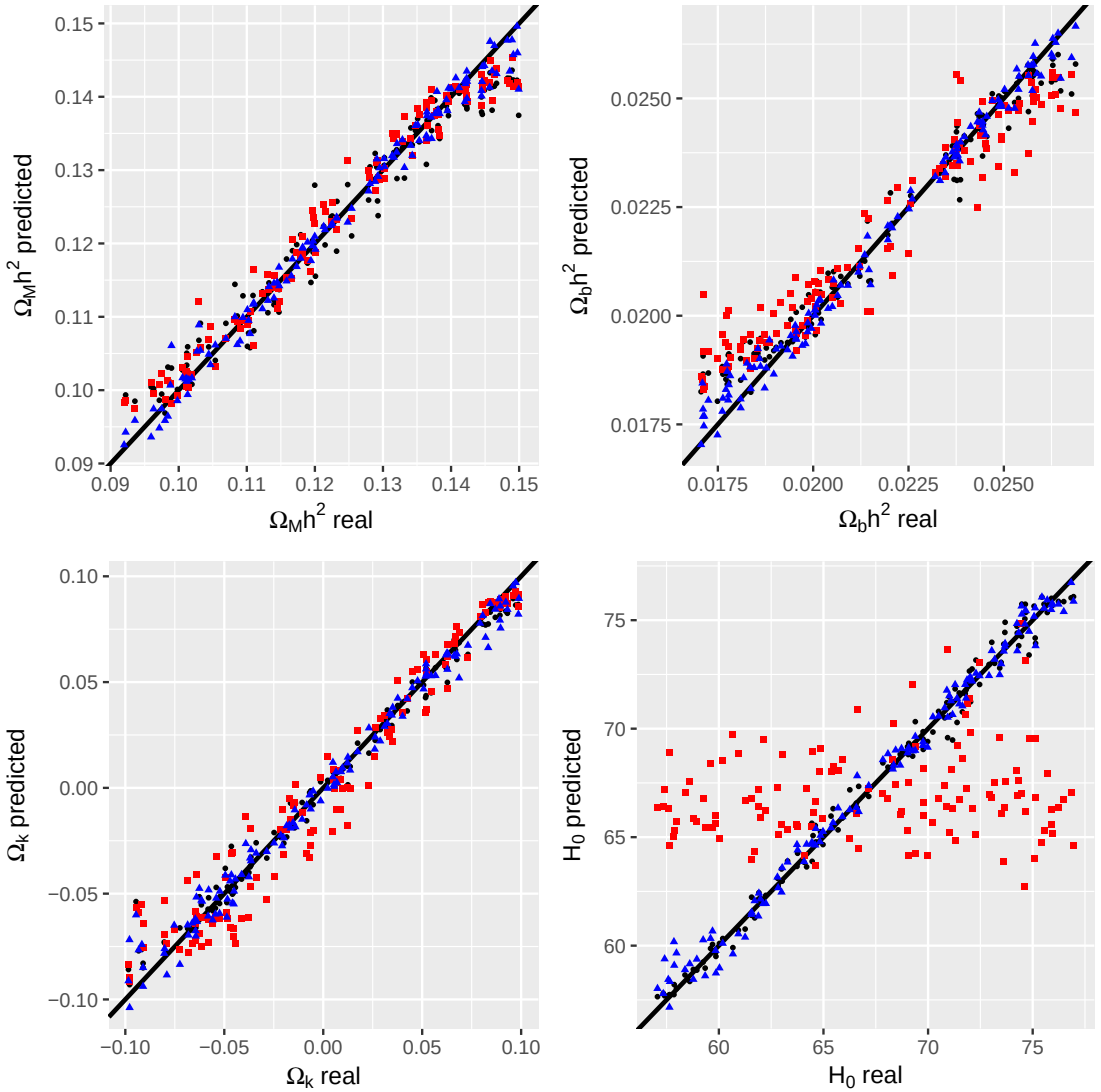
The training sample.

CAMB: Code for Anisotropies in the Cosmic Background

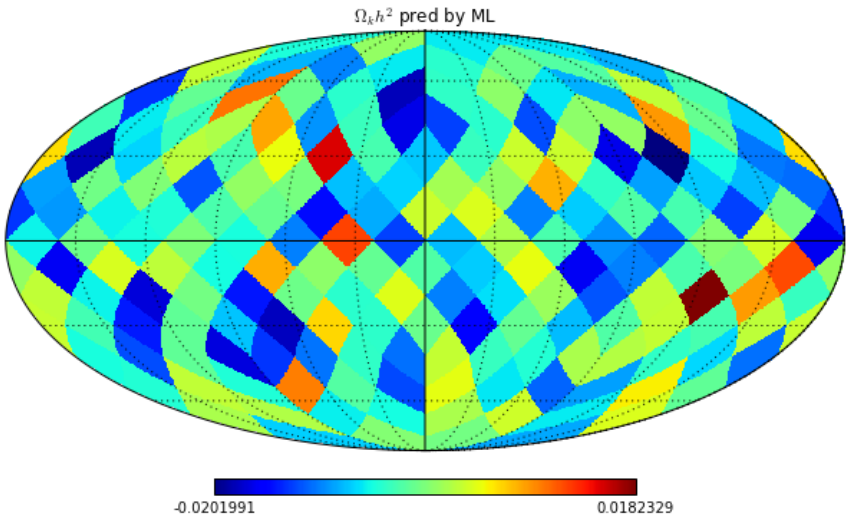


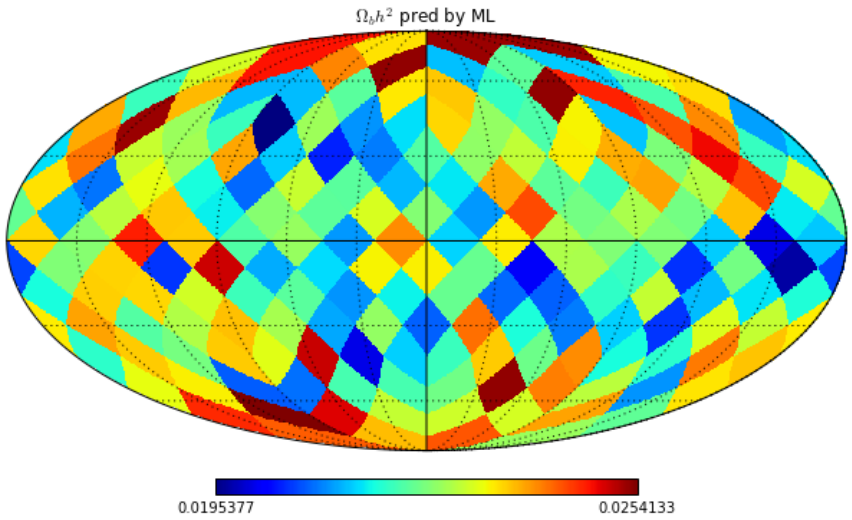


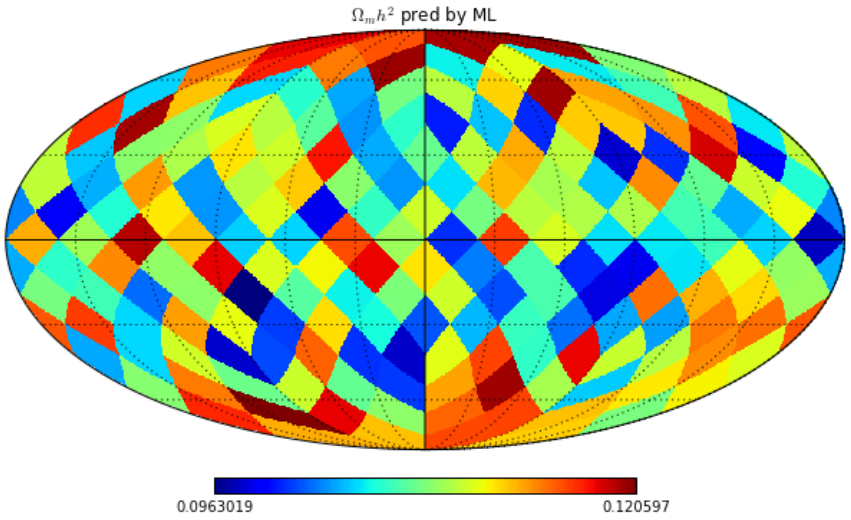
Studying different Machine Learning algorithms.

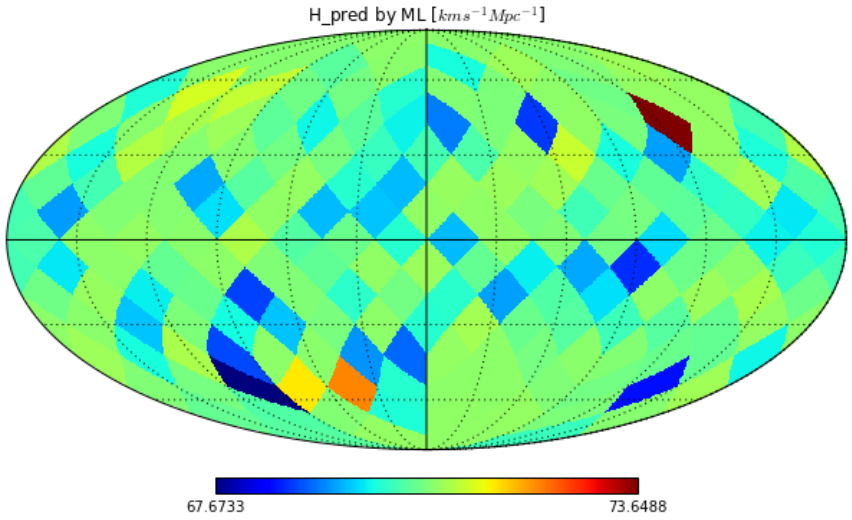


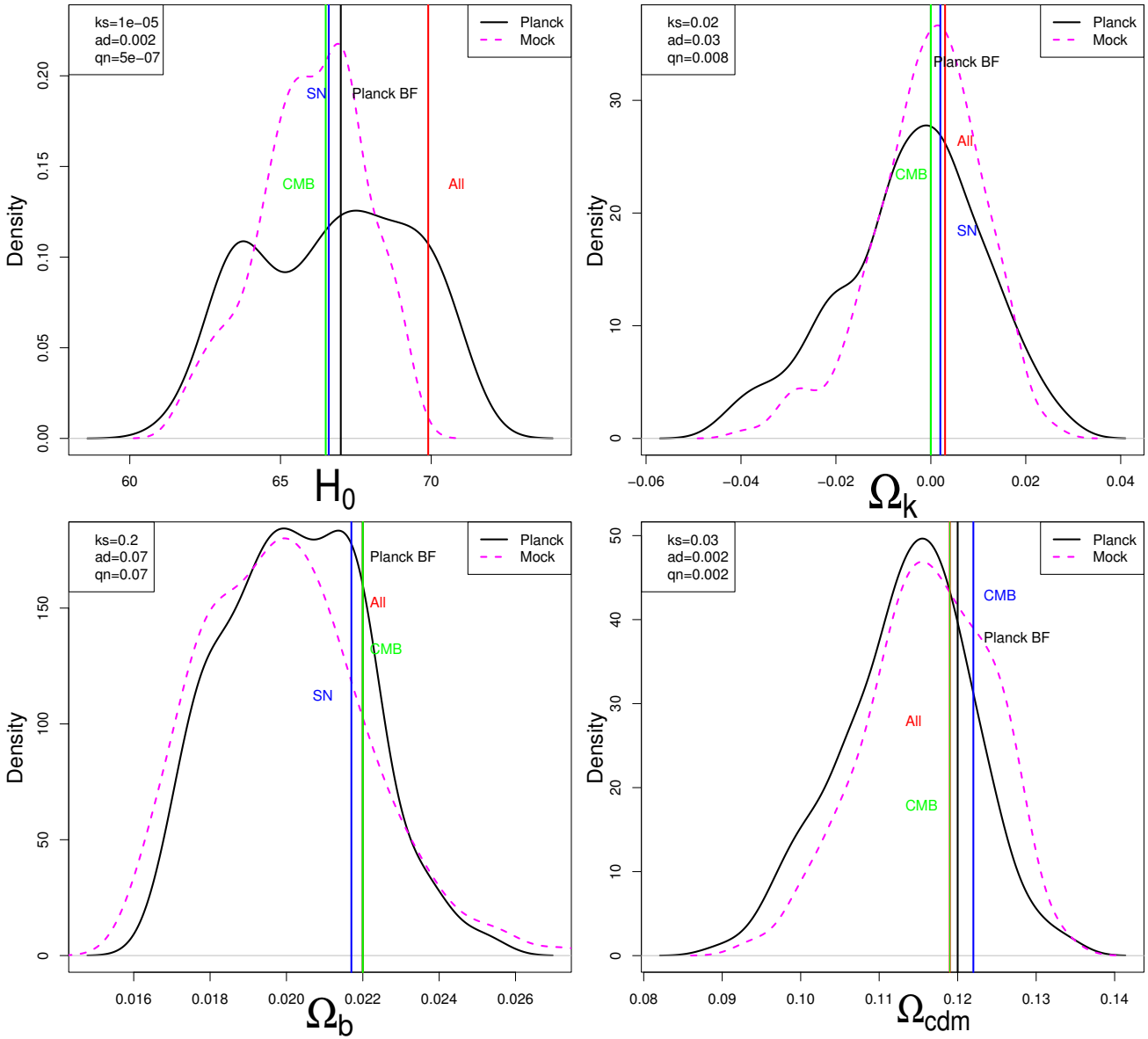
First Results.







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qn=5e−07
Planck
Mock
SN
Planck BF
CMB
All
Density
H_0
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qn=0.008
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Mock
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All
CMB
SN
Density
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Planck BF
All
CMB
SN
Density
Ω_b
ks=0.03
ad=0.002
qn=0.002
Planck
Mock
CMB
Planck BF
All
CMB
Density
Ω_{cdm}

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Final Remarks

- We developed a machine learning technique that estimate the cosmological parameters in a more efficient way, and allow us to measure the angular distribution of this parameters.
- This technique can be easily extended to use more cosmological information as features (BAO, correlation function, SZ emission, etc.).
- We do not found statistically significant departures from what is expected in an homogeneous and isotropic universe, with the possible exception of a bi-modal H_0 distribution.
- We will extend the parameters space and add polarization information in a forthcoming work.
- We will analyze the correlations between the angular distribution of the cosmological parameters and the large scale structure (voids, filaments, etc.)


THANK YOU!!