

Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Machine Learning techniques applied to cosmological problems.

Martín de los Ríos

Director: Dr. Mariano Domínguez

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The MeSsI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Resumen

Introduction to Machine Learning techniques.

The MeSsI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

A2029/2033.

A1204.

A267.

Statistical analysis of the magnetic fields in merging clusters.

CosmoML:Machine Learning techniques applied to the CMB.

Construction of the data set.

Supervised methods.

Cosmological parameters Angular distributions.

Conclusions.

Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

A2029/2033.

A1204.

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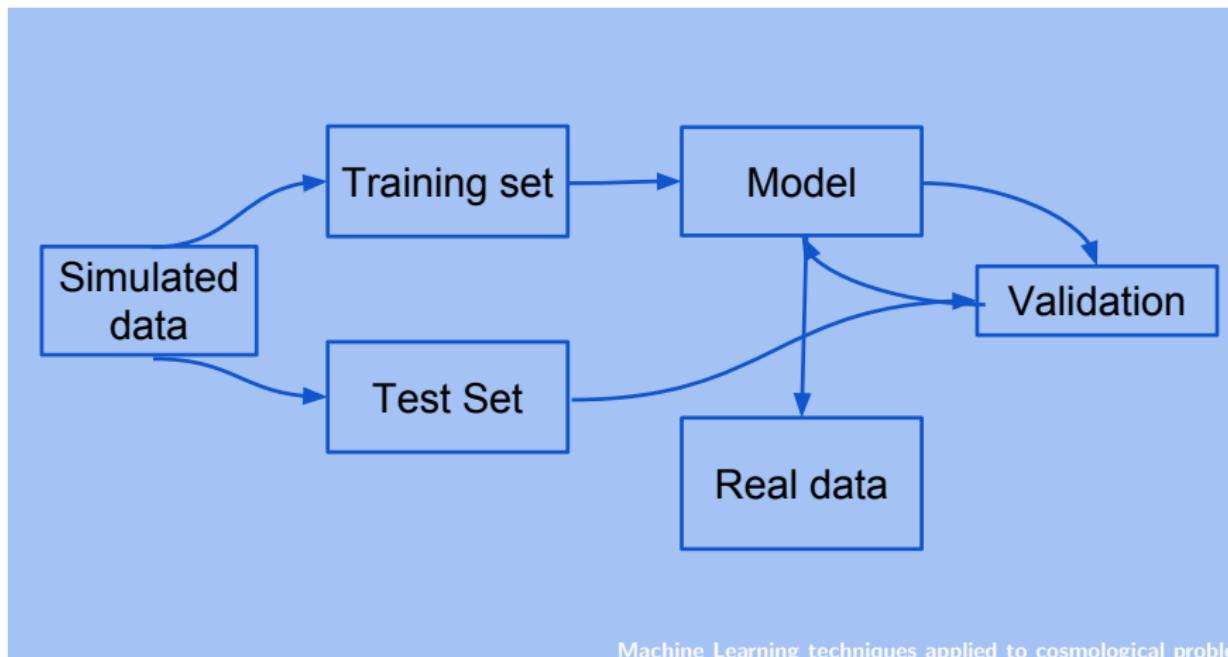
Construction of the data set.

Supervised methods.

Cosmological parameters Angular distributions.

Conclusions.

Supervised Learning.



Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Random Forest

Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

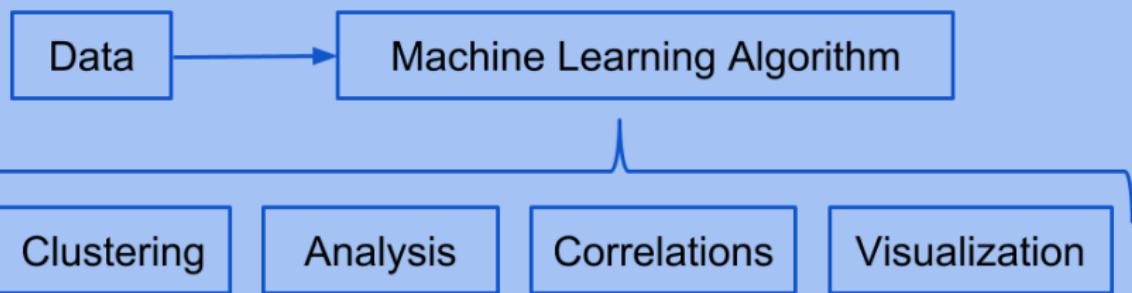
Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Support Vector Machines

Unsupervised Learning.



Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

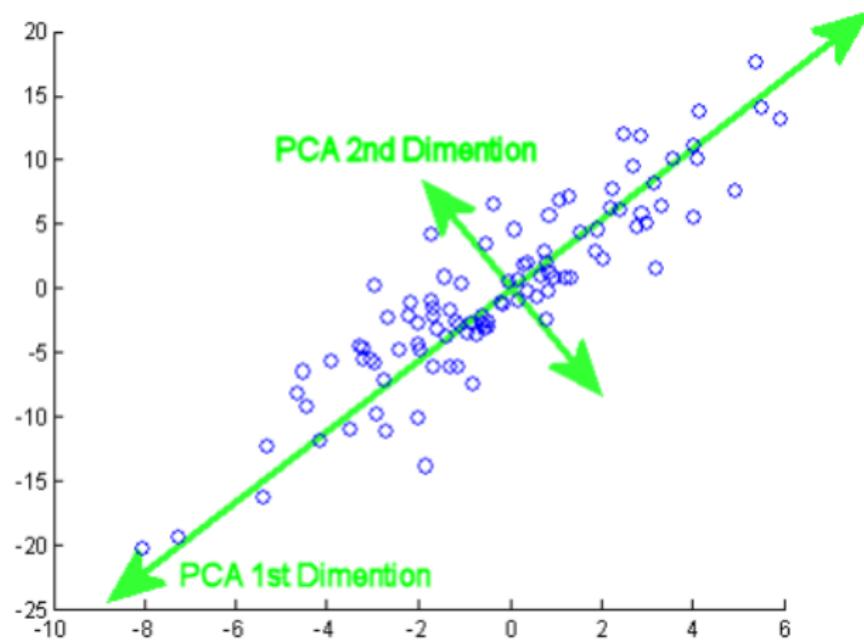
Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Mixture of Gaussians

Principal Components Analysis.



Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

A2029/2033.

A1204.

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CosmoML:Machine Learning techniques applied to the CMB.

Construction of the data set.

Supervised methods.

Cosmological parameters Angular distributions.

Conclusions.

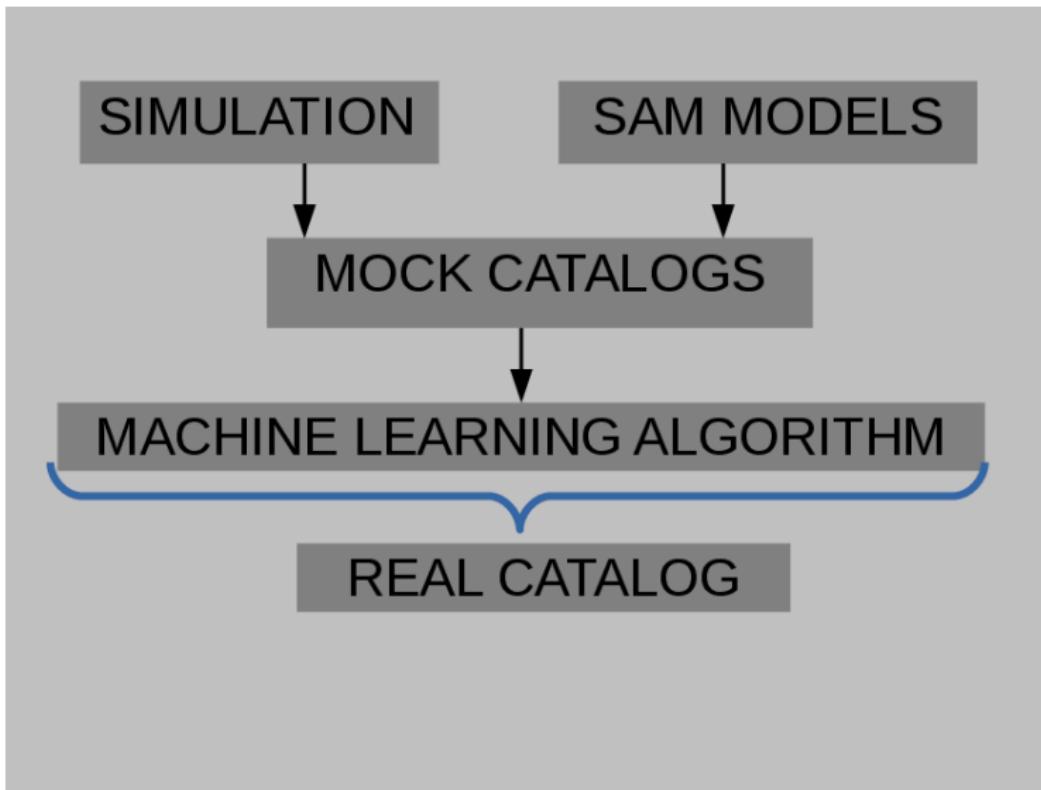
The MeSSI (Merging Systems Identification) Algorithm & Catalogue.

Martín de los Ríos^{*}, Mariano J. Domínguez R.[†], Dante Paz, Manuel Merchán^{‡,3}.

¹ Instituto de Astronomía Teórica y Experimental (CCT-Córdoba - CONICET, UNC), Laprida 854, X5000BGR, Córdoba, Argentina.

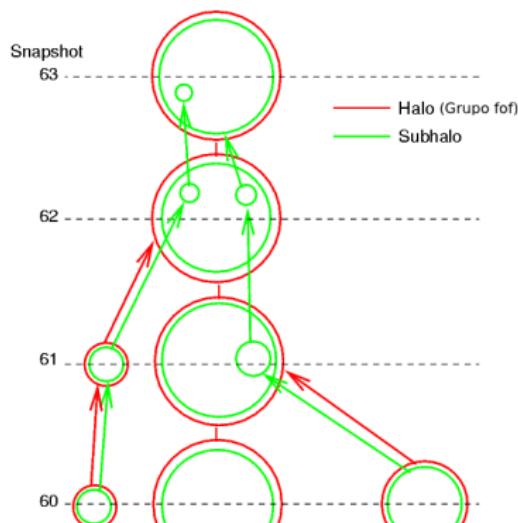
² Observatorio Astronómico de Córdoba, Universidad Nacional de Córdoba, Laprida 854, X5000BGR, Córdoba, Argentina.

³ Consejo Nacional de Investigaciones Científicas y Técnicas, Rivadavia 1917, C1033AAJ Buenos Aires, Argentina.

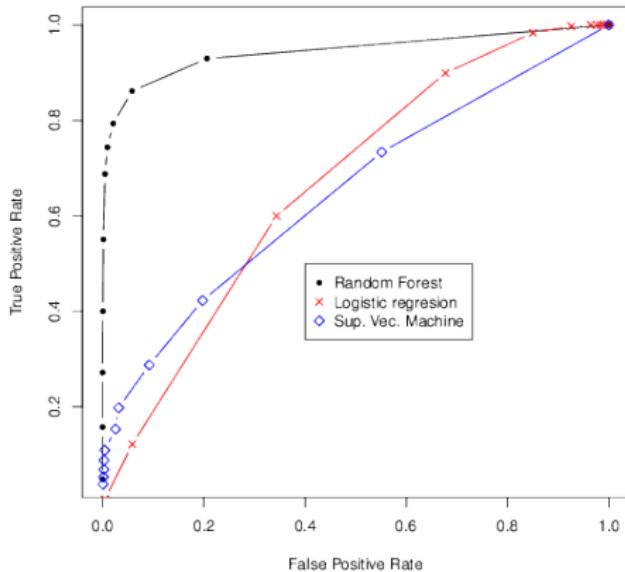


Study of the merger trees.

- ▶ Based on the subhalos merger trees, we construct the merger tree for every fof group in the simulation.



- ▶ Dressler-Shectman test.
- ▶ Non gaussianity test.
- ▶ Color.
- ▶ Number of galaxies.



- ▶ We found 61 candidates to merging clusters.
- ▶ In 32 of these we were able to identify the colliding substructures.
- ▶ 21 of these were previously classified as merging clusters by other authors.

| Name | $M_1 [10^{14} M_\odot]$ | $RA_1 [\text{h}]$ | $DEC_1 [\text{d}]$ | z_1 | $M_2 [10^{14} M_\odot]$ | $RA_2 [\text{h}]$ | $DEC_2 [\text{d}]$ | z_2 |
|---------------|-------------------------|-------------------|--------------------|-------------------|-------------------------|-------------------|--------------------|-------------------|
| Abell 1991 | 5.7 ±1.2 | 223.58 ±0.05 | 18.53 ±0.09 | 0.0583 ±0.0003 | 2.6 ±1.02 | 223.67 ±0.6 | 18.67 ±0.1 | 0.0586 ±0.0003 |
| Abell 1424 | 4.9 ±2.3 | 179.38 ±0.09 | 5.08 ±0.02 | 0.0760 ±0.0004 | 5.1 ±1.4 | 179.19 ±0.1 | 5.01 ±0.04 | 0.0746 ±0.0005 |
| Abell 1589 | 5.5 ✓ ±0.4 | 190.25 ±0.01 | 18.53 ±0.02 | 0.0721 ±0.0001 | 1.1 ±0.5 | 190.34 ±0.01 | 18.22 ±0.005 | 0.0716 ±0.0002 |
| 31170 | 25.4 ±0.8 | 255.63 ±0.05 | 34.06 ±0.05 | 0.0993 ±0.0001 | 13.3 ±1.3 | 255.76 ±0.05 | 33.90 ±0.005 | 0.0989 ±0.0005 |
| Abell 2029/33 | 24.3 ±4.6 | 227.73 ±0.05 | 5.68 ±0.1 | 0.0796 ±0.0004 | 13.4 ±1.8 | 227.81 ±0.1 | 6.13 ±0.2 | 0.0805 ±0.0009 |
| Abell 2069 | 22.6 ✓ ±6.8 | 230.99 ±0.05 | 29.94 ±0.04 | 0.1146 ±0.0002 | 32 ±1.0 | 231.07 ±0.05 | 29.86 ±0.09 | 0.1146 ±0.0004 |
| Abell 2142 | 18.3 ✓ ±0.6 | 239.61 ±0.005 | 27.23 ±0.005 | 0.0901 ±0.0004 | 11.3 ±1.8 | 239.33 ±0.005 | 27.5 ±0.005 | 0.0893 ±0.0001 |
| Abell 1913 | 5.5 ✓ ±1.1 | 216.73 ±0.02 | 16.75 ±0.06 | 0.0530 ±0.0004 | 2.1 ±1.4 | 216.84 ±0.04 | 16.62 ±0.1 | 0.0533 ±0.0013 |
| Abell 2399 | 5.1 ±0.3 | 329.29 ±0.02 | -7.81 ±0.02 | 0.0576 ±0.0001 | 2.4 ±0.3 | 329.49 ±0.04 | -7.79 ±0.02 | 0.0581 ±0.0002 |
| Abell 85 | 7.4 ✓ ±0.3 | 10.425 ±0.005 | -9.25 ±0.01 | 0.0559 ±0.0001 | 1.8 ±1.1 | 10.47 ±0.01 | -9.51 ±0.05 | 0.0573 ±0.002 |
| 55731 | 1.9 ±0.4 | 244.72 ±0.06 | 24.21 ±0.08 | 0.0661 ±0.0004 | 2.05 ±0.3 | 244.63 ±0.07 | 24.32 ±0.08 | 0.0656 ±0.0005 |
| Abell 1750 | 8.7 ✓ ±1.1 | 202.80 ±0.02 | -1.89 ±0.02 | 0.0868 ±0.0009 | 7.5 ±1.6 | 202.82 ±0.04 | -1.73 ±0.1 | 0.0848 ±0.0016 |
| Abell 3158 | 37.24 ✓ ±1.5 | 55.75 ±0.07 | -53.63 ±0.004 | 0.0633 ±0.0001 | 4.6 ±0.2 | 55.37 ±0.007 | -53.48 ±0.001 | 0.0622 ±0.0001 |
| Abell 376 | 19.7 ±1.4 | 41.46 ±0.006 | 36.89 ±0.005 | 0.0478 ±0.0001 | 4.01 ±1.09 | 41.72 ±0.003 | 36.94 ±0.007 | 0.0489 ±0.0002 |
| Abell 3490 | 44.76 ±4.3 | 176.42 ±0.02 | -34.37 ±0.01 | 0.0688 ±0.0001 | 116.5 ±40.4 | 176.1 ±0.1 | -34.39 ±0.1 | 0.0727 ±0.001 |
| Abell 2382 | 77.7 | 327.90 | -15.66 | 0.0676 | 6.12 | 328.167 | -15.62 | 0.0642 |

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Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

A2029/2033.

A1204.

A267.

Statistical analysis of the magnetic fields in merging clusters.

Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

A2029/2033.

A1204.

A267.

Statistical analysis of the magnetic fields in merging clusters.

CosmoML:Machine Learning techniques applied to the CMB.

Construction of the data set.

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Cosmological parameters Angular distributions.

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I. Analysis of candidates for interacting galaxy clusters

A1204 and A2029/A2033

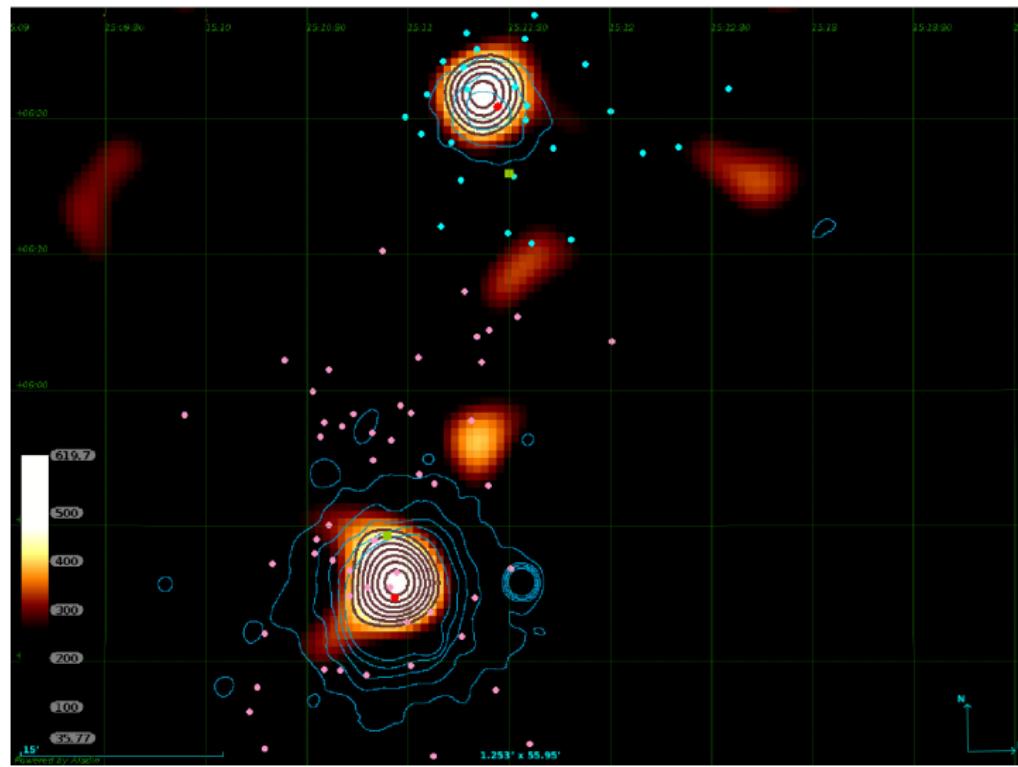
Elizabeth Johana Gonzalez ^{★1,2}, Martín de los Ríos^{1,2}, Gabriel A. Oio^{1,2}, Daniel Hernández Lang⁴, Tania Paez Tagliaferro^{1,2}, Mariano J. Domínguez R.^{1,2}, José Luis Nilo Castellón^{3,4}, Héctor Cuevas L.⁴, and Carlos A. Valotto^{1,2}

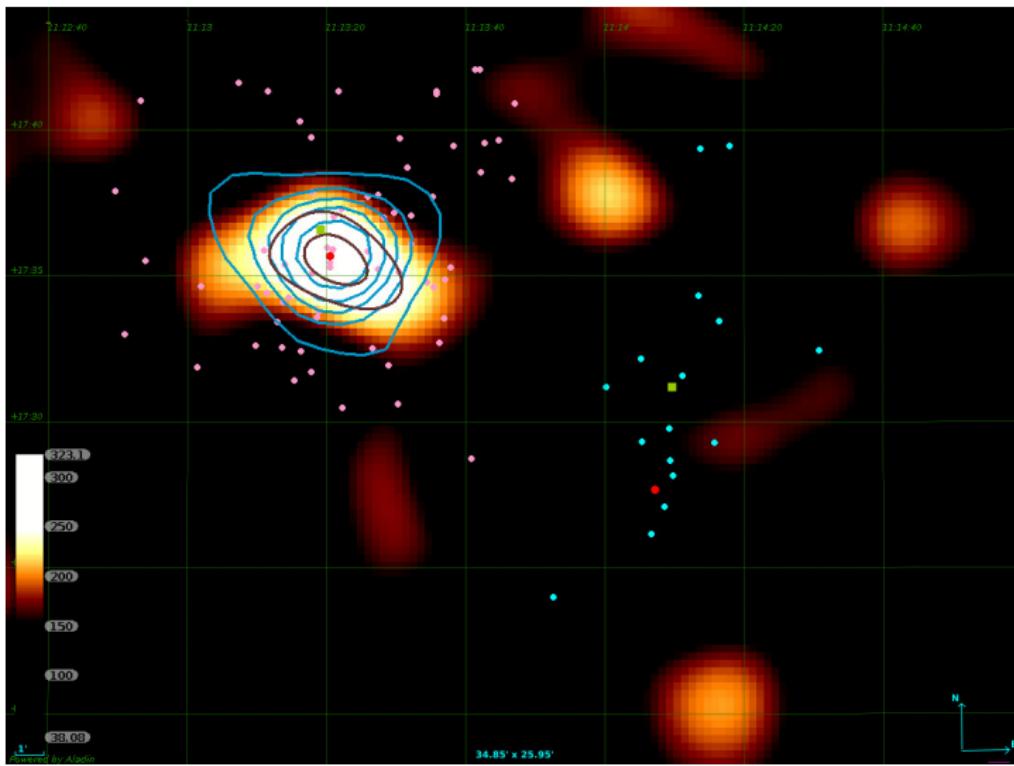
¹ Instituto de Astronomía Teórica y Experimental, (IATE-CONICET), Laprida 854, X5000BGR, Córdoba, Argentina.

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II. Analysis of candidates for interacting galaxy clusters: A267, a merging fossil group.

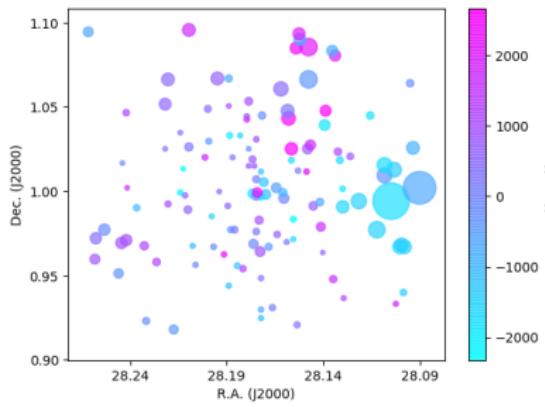
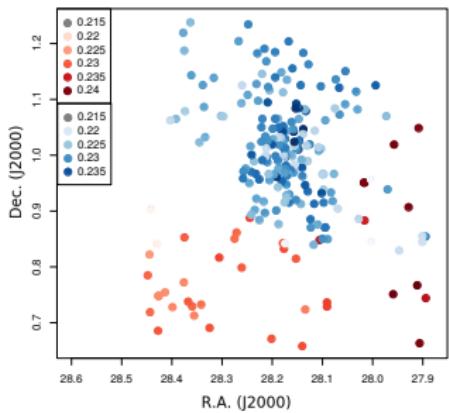
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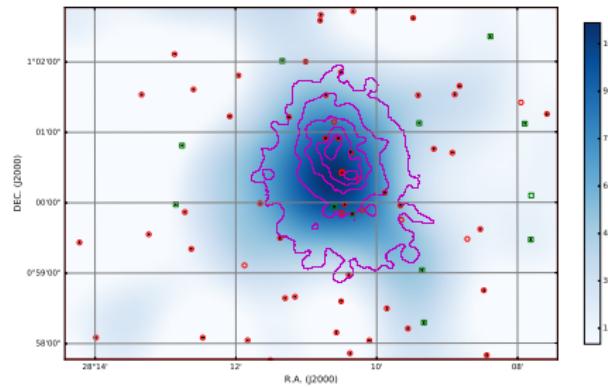
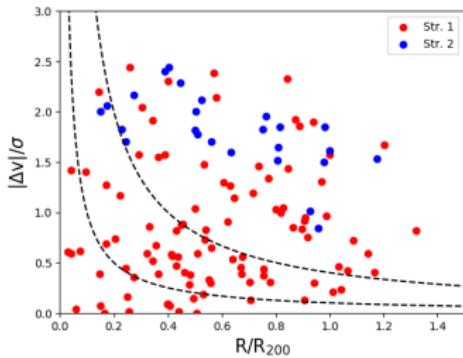
¹ Instituto de Astronomía Teórica y Experimental, (IATE-CONICET), Laprida 854, X5000BGR, Córdoba, Argentina.

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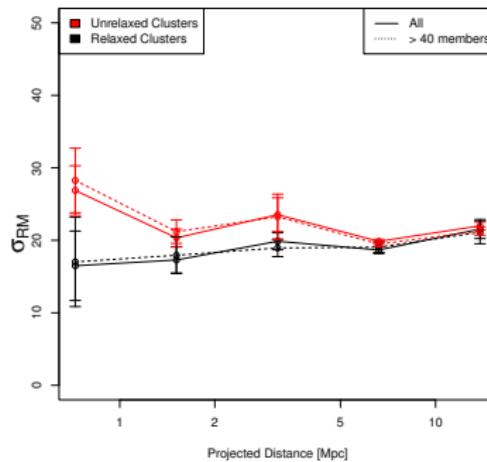
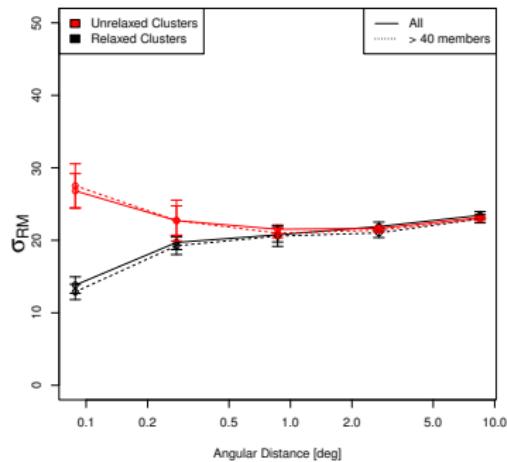
Faraday Rotation Measure dependence with galaxy clusters dynamics

F.A. Stasyszyn^{1,2} & M. de los Rios^{1,2,3}

¹ *Instituto de Astrofísica Teórica y Experimental (IATE), Laprida 854, Córdoba, Argentina*

² *Observatorio Astronómico de Córdoba, Universidad Nacional de Córdoba, Laprida 854, X5000BGR, Córdoba, Argentina.*

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Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Construction of the data set.

Supervised methods.

Cosmological parameters Angular distributions.

Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

A2029/2033.

A1204.

A267.

Statistical analysis of the magnetic fields in merging clusters.

CosmoML:Machine Learning techniques applied to the CMB.

Construction of the data set.

Supervised methods.

Cosmological parameters Angular distributions.

Conclusions.

CosmoML: Machine Learning techniques applied to the Cosmic Microwave Background.

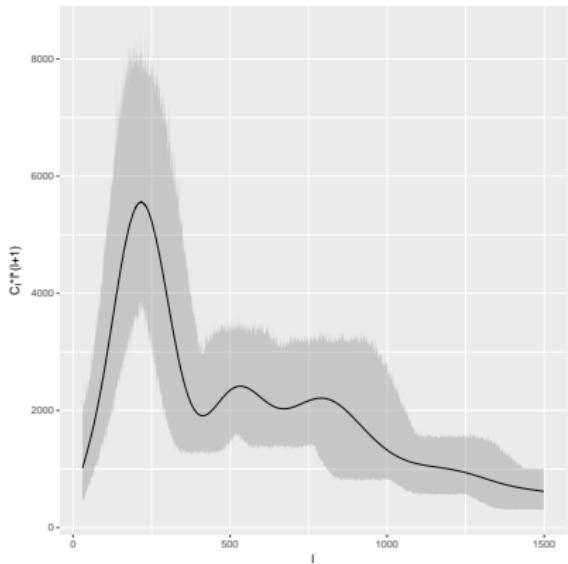
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| Parameter | Minimum | Maximum | Planck |
|----------------|------------------------|------------------------|------------------------|
| $\Omega_m h^2$ | 0.1131 | 0.1263 | 0.1197 |
| $\Omega_b h^2$ | 0.02131 | 0.02269 | 0.022 |
| Ω_k | -0.1 | 0.1 | 0 |
| H_0 | 62.31 | 72.31 | 67.31 |
| n | 0.9469 | 0.9841 | 0.9655 |
| A_s | 1.988×10^{-9} | 2.408×10^{-9} | 2.198×10^{-9} |
| τ | 0.021 | 0.1349 | 0.078 |



Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

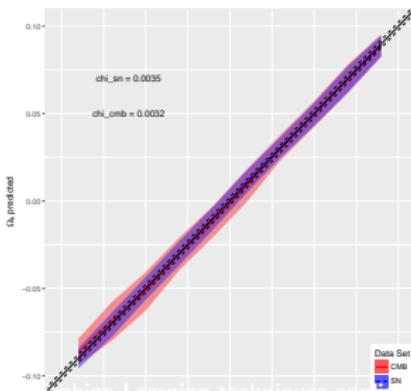
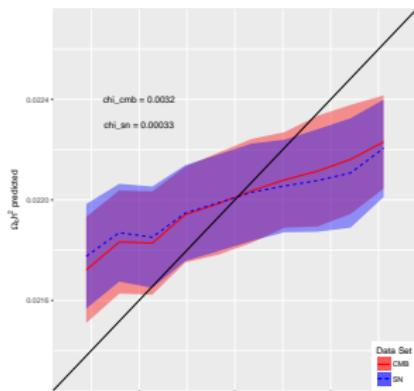
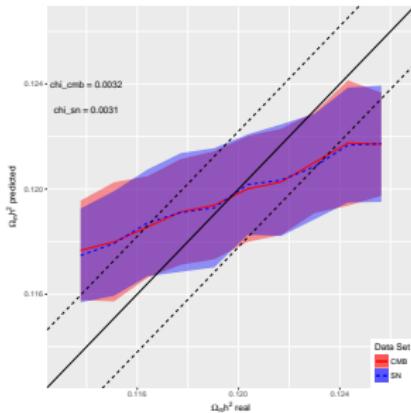
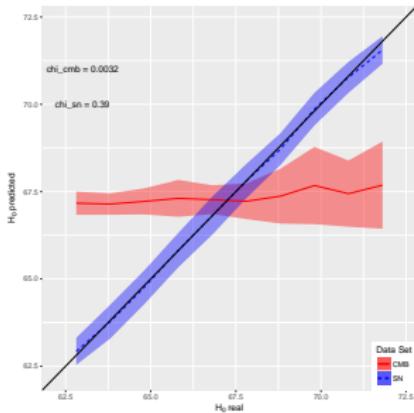
CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Construction of the data set.

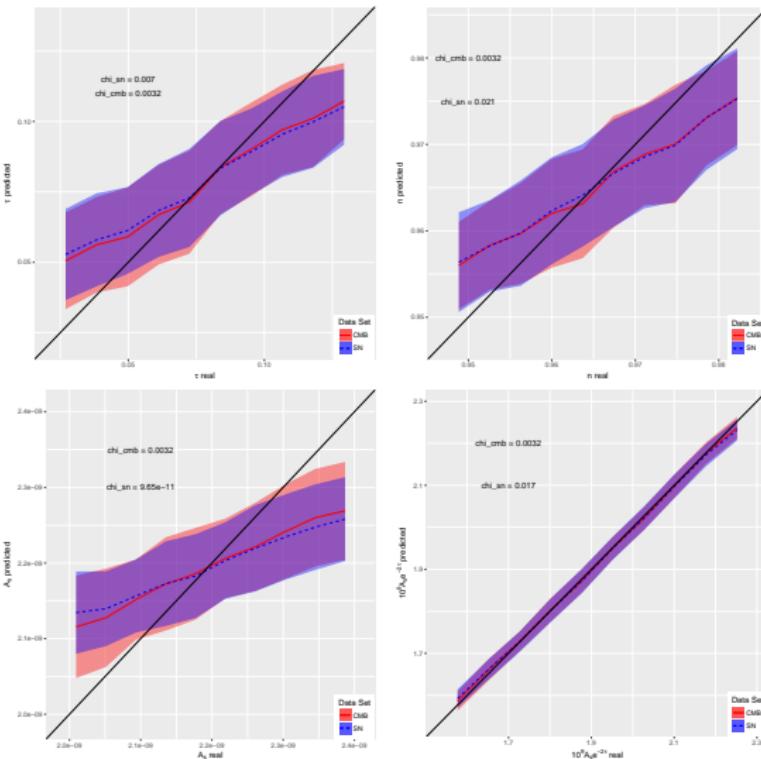
Supervised methods.

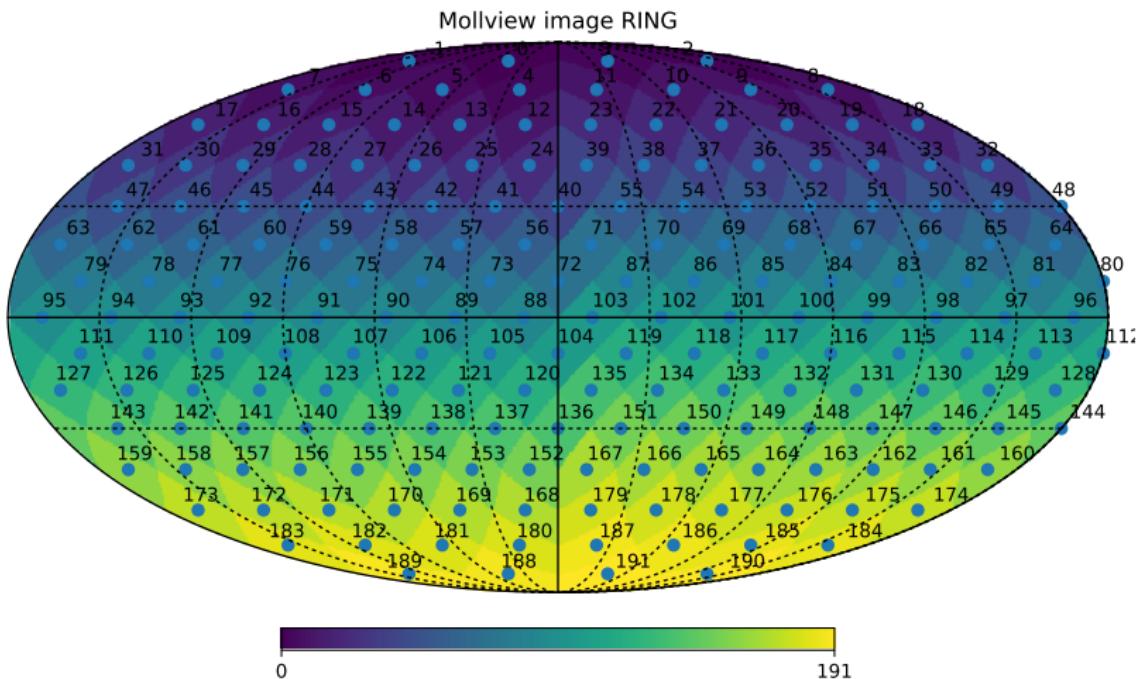
Cosmological parameters Angular distributions.



Introduction to Machine Learning techniques.
The MeSSI (Merging Systems Identification) Algorithm.
Analysis of individual merging clusters candidates.
CosmoML:Machine Learning techniques applied to the CMB.
Conclusions.

Construction of the data set.
Supervised methods.
Cosmological parameters Angular distributions.





Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

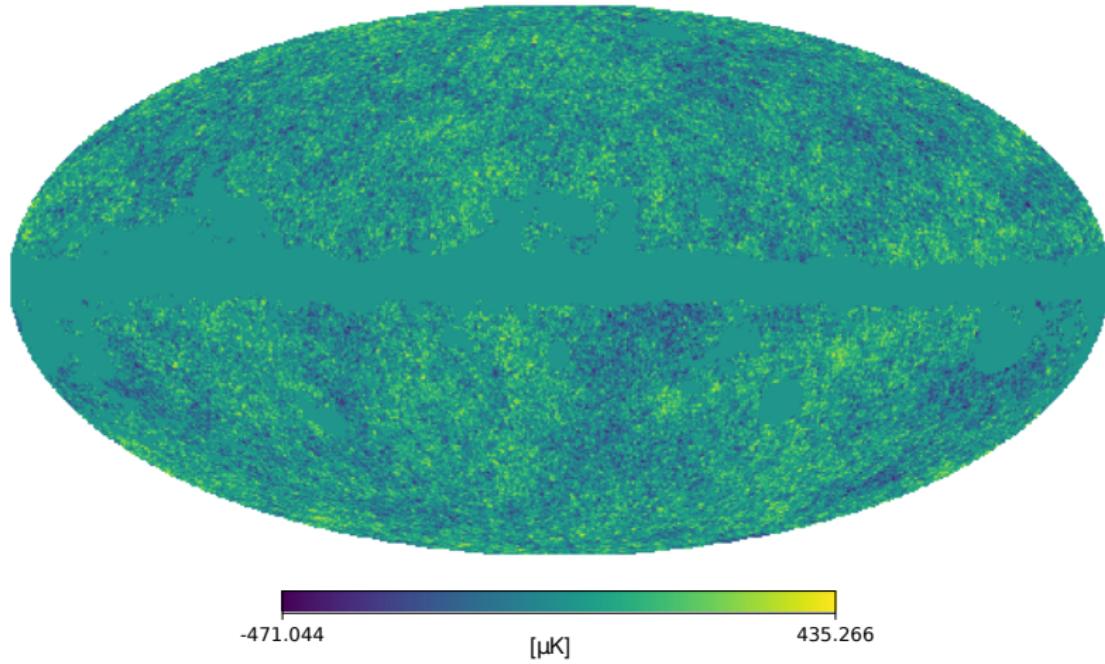
Conclusions.

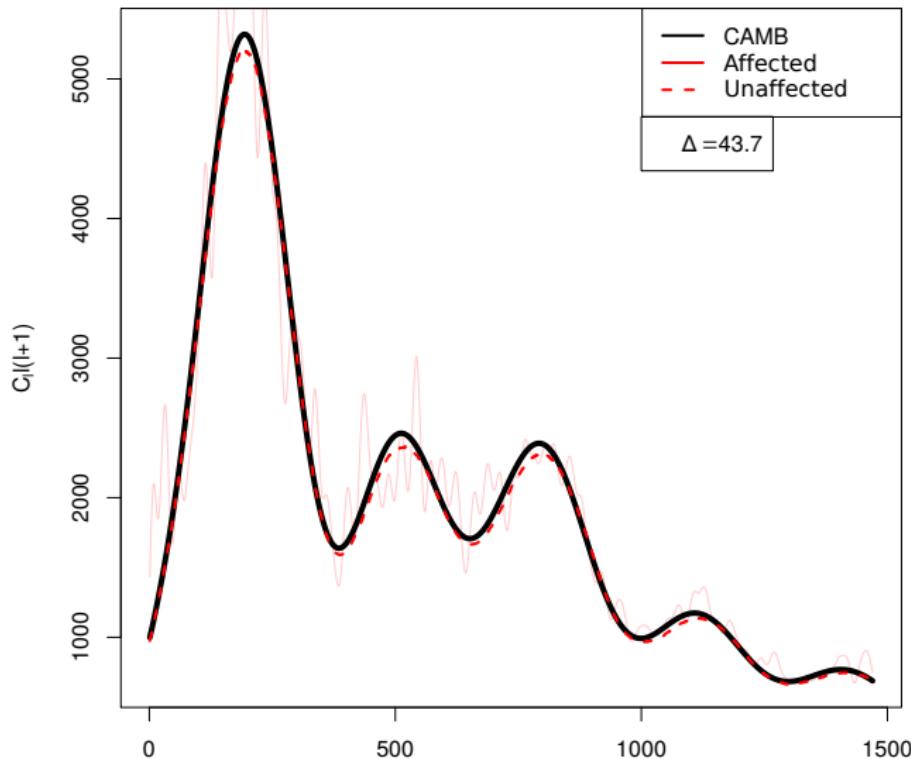
Construction of the data set.

Supervised methods.

Cosmological parameters Angular distributions.

Mollweide view





Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

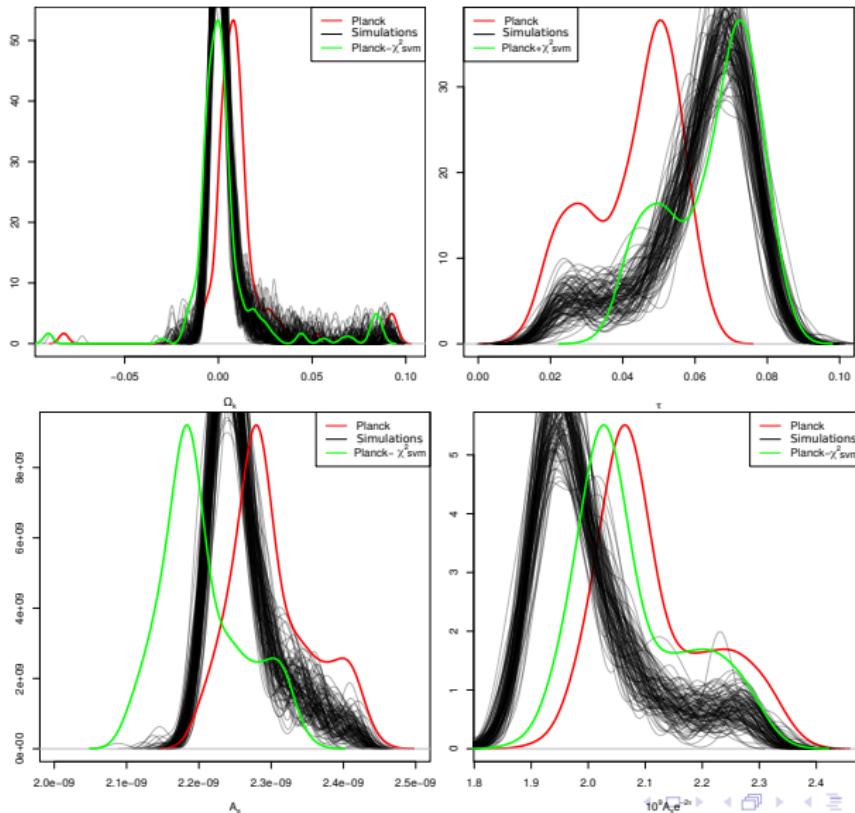
CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Construction of the data set.

Supervised methods.

Cosmological parameters Angular distributions.



Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

A2029/2033.

A1204.

A267.

Statistical analysis of the magnetic fields in merging clusters.

CosmoML:Machine Learning techniques applied to the CMB.

Construction of the data set.

Supervised methods.

Cosmological parameters Angular distributions.

Conclusions.

Introduction to Machine Learning techniques.

The MeSSI (Merging Systems Identification) Algorithm.

Analysis of individual merging clusters candidates.

CosmoML:Machine Learning techniques applied to the CMB.

Conclusions.

Muchas

Gracias

