

## ONRG: INTERIM PROGRESS (FINAL) REPORT

**Title:** Analysis of real sonar type scatter data using the point cloud method.

**Award number:** N62909-18-1-2098

**DUNS#:** 588138677

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**Relevant item within opportunity:** Code 600, ONRG.

**Principal Investigator:**

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1. Major Goals:

The major goal of the project was to improved on the pint cloud method presented in Palafox (2017): Palafox, A., M. Capistrán, and J. A. Christen (2017), “Point cloud-based scatterer approximation and affine invariant sampling in the inverse scattering problem”, *Mathematical Methods in the Applied Sciences* **40**(9), 3393–3403.

The project proposed to explore new methodological improvements. Specifically, using real data and also advancing on non-convex shapes.

2. Accomplished:

The main contribution to improve on the point cloud methods is found in Daza-Torres, del Río, Capistrán, and Christen (2018). Computational geometric methods are used, using a non-convex alpha shape algorithm, to achieve a generalization of Palafox (2017).

Several other papers were published, using this project as partial support, namely Blaauw, Christen, and Aquino-López (2020); Capistrán and del Río (2020); Capistrán, Vinh, and Tuan (2020); Christen and Parker (2020); Parker, Christen, Lorenz, and Smith (2020). In section “Dissemination” we include the list of these published papers, including Daza-Torres et al. (2018).

3. Training:

The postdocs Dr María Luisa Daza-Torres and Dr Luis Blanco-Cocom were partially supported by this project. Dr Daza-Torres finished her postdoc in August 2019 and Dr Blanco-Cocom will conclude his work in August this year.

4. Dissemination:

We cite here all published papers related to this grant (note that Daza-Torres et al. (2018) has not, as yet, been peer reviewed published; it is submitted). Moreover, off-prints of these papers may be downloaded from: [https://drive.google.com/drive/folders/1jCF9H6J6Nz79DmwYYq\\_ikVLlhZ9RLvF0?usp=sharing](https://drive.google.com/drive/folders/1jCF9H6J6Nz79DmwYYq_ikVLlhZ9RLvF0?usp=sharing).

## References

- Blaauw, M., J. A. Christen, and M. A. Aquino-López (2020). A review of statistics in palaeoenvironmental research. *Journal of Agricultural, Biological and Environmental Statistics* **25**(1), 17–31.
- Capistrán, M. A. and J. A. I. del Río (2020). Estimating a pressure dependent thermal conductivity coefficient with applications in food technology. *Inverse Problems in Science and Engineering* **28**(2), 277–293.
- Capistrán, M. A., P. C. Vinh, and T. T. Tuan (2020). Reliability assessment and data inversion using a surrogate model of wave propagation in functionally graded materials. *Inverse Problems in Science and Engineering* **28**(5), 614–636.

Christen, J. A. and A. E. Parker (2020). Systematic statistical analysis of microbial data from dilution series. *Journal of Agricultural, Biological and Environmental Statistics*.

Daza-Torres, M. L., J. A. I. del Río, M. A. Capistrán, and J. A. Christen (2018). A computational geometry method for the inverse scattering problem.

Parker, A., J. Christen, L. Lorenz, and H. Smith (2020). Optimal surface estimation and thresholding of confocal microscope images of biofilms using beer’s law. *Journal of Microbiological Methods* 174, 105943.

5. Plans:

The project concluded in April 2020. An extension was granted due to the COVID19 situation. This allowed the PI to prepare this final report, since I am involved in research concerning the epidemic. However, the financial report is with a balance of 0 and no further activities are considered for this research grant.

6. Honors:

No formal honors are related to this project.

7. Technology Transfer:

No technological transfer. No DoD agency provided feedback (e.g. data).

8. Participants:

- Dr J Andrés Christen (CIMAT-CONACYT), Principal Investigator-
- Dr Marcos A. Capistrán (CIMAT-CONACYT), professor and main collaborator.
- Dr Antonio Capella (IM-UNAM), professor and main collaborator.
- Dr Maria Luisa Daza-Torres (formerly CIMAT-CONACYT, now at UG), postdoc under PI’s supervision.
- Dr Luis Blanco-Cocom (CIMAT-CONACYT), current postdoc under PI’s supervision.
- Mr José Cricelio Montesinos (CIMAT-CONACYT), PhD student under PI’s supervision.
- Mr Hugo Flores (CIMAT-CONACYT), PhD student under the supervision of dr Capistrán.