LidarView Presentation - IGN

2023-06-29 G.Ferret

kitware

Contact: gatien.ferret@kitware.com

Summary

- Kitware quick overview

- Overview of VTK / ParaView

- LidarView : A Paraview Based App

- ParaView/ LidarView for distributed applications

- Potential applications to aerial lidar data

Kitware quick overview

Kitware / Leader in AI & scientific open source solutions

Software development
Based on open source tools
300+ active projects worldwide

Sustained Growth
Since creation of the company
100% employee-owned

230 employees Worldwide
6 offices across USA/Europe

Most staff with PhD or Master
High Level customer expertise

25 years of expertise
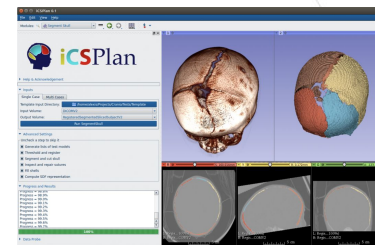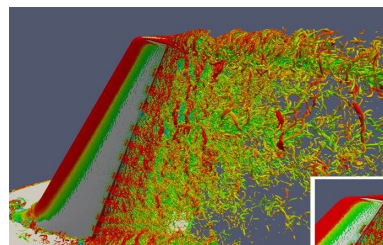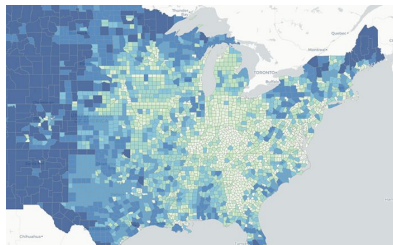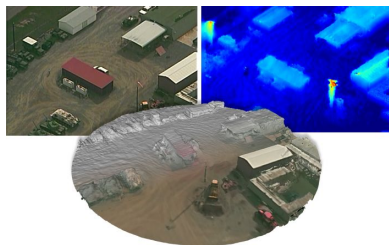Kitware USA, 1998
Kitware Europe, 2010

Revenue 2020
$39M consolidated

kitware

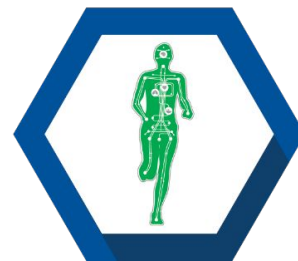# Areas of expertise / Built on open source

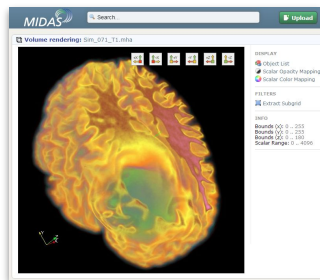

Computer Vision

Data and Analytics

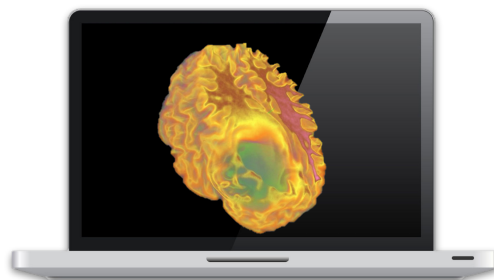Scientific Computing

Medical Computing

Software Solutions

kitware

Applications / Universal Platforms

Web

Desktop
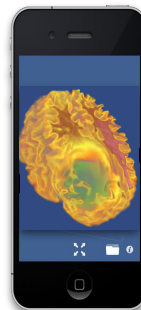
Mobile

Cloud /HPC

kitware
Platforms

3D Slicer   ParaView   KWIVER   imstk   VTK
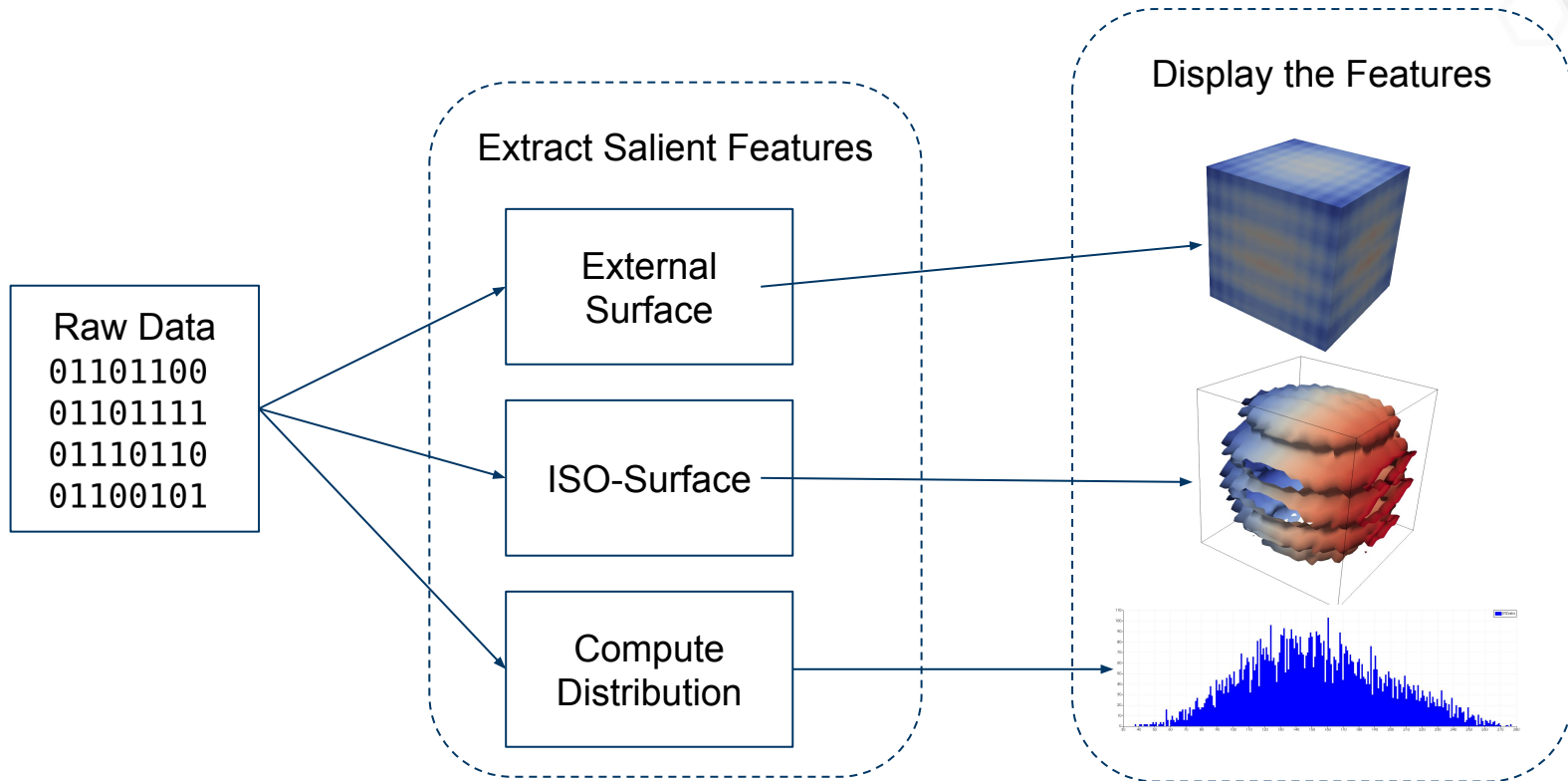
Pulse Physiology Engine   CMake   Resonant   tomviz   ITK

Overview of VTK / ParaView

Scientific Visualization Basics

Raw Data
01101100
01101111
01110110
01100101

Extract Salient Features

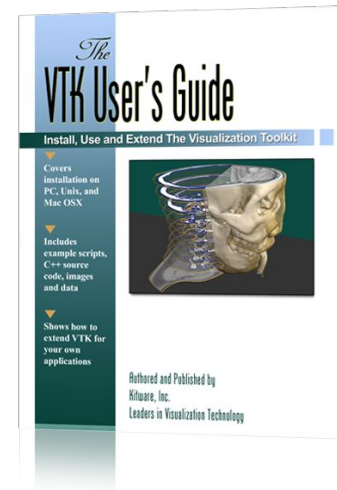External Surface
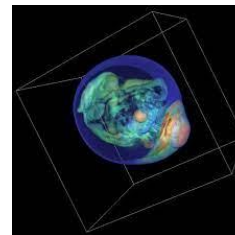
ISO-Surface

Compute Distribution
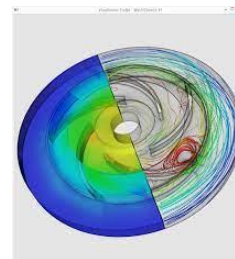
Display the Features

# VTK / Cross-Platform Visualization Toolkit (1993)

- **Open-source (BSD-3 licence), freely available, cross-platform toolkit for post-processing and visualization of scientific data**

ParaView / High-Performance Post-Processing (2002)

- **Open-source, multi-platform, data analysis and visualization application**
- **Analysis of extremely large datasets using distributed memory computing resources**
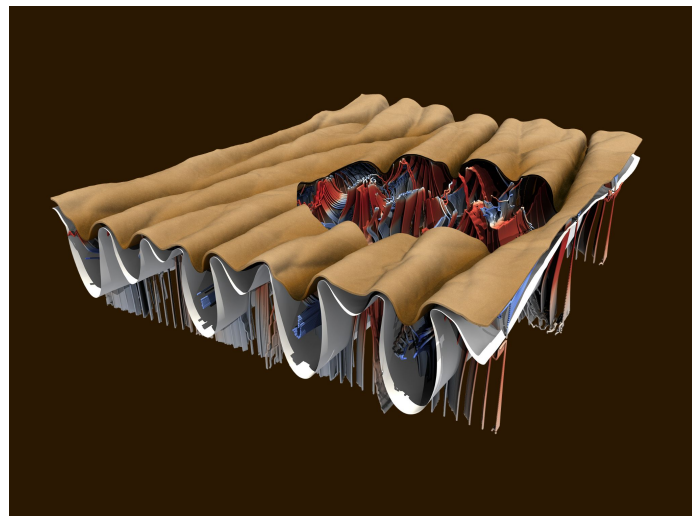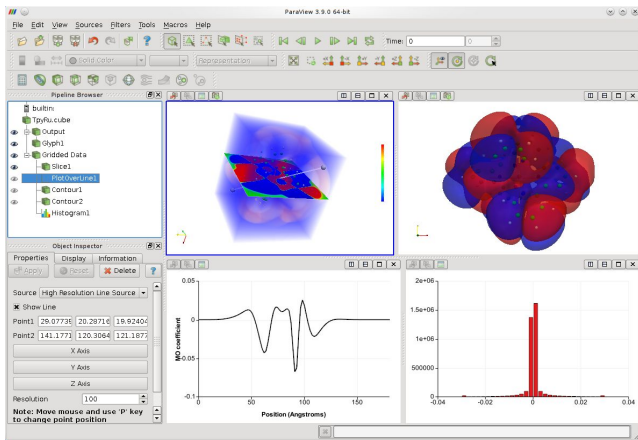
kitware
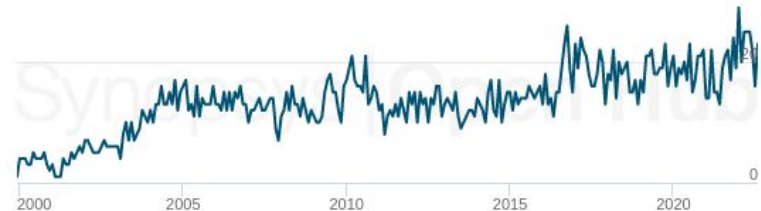
ParaView Community

- Open Source Software (BSD license)
- Run on most of Top500 HPC
- 300000+ download yearly from Kitware servers
  - More users via other unknown download channel (Linux packaging, Enterprise distribution…)
- 157k commits made by 339 contributors since 2000
- 1.6M lines of code

TOP 500
The List.

Contributors per Month

2000   2005   2010   2015   2020

kitware

11

ParaView Ecosystem

Batch mode
(ParaView
Python)

ParaView
Client

ParaView Server

ParaView Web

trame

LidarView : A Paraview based app

kitware
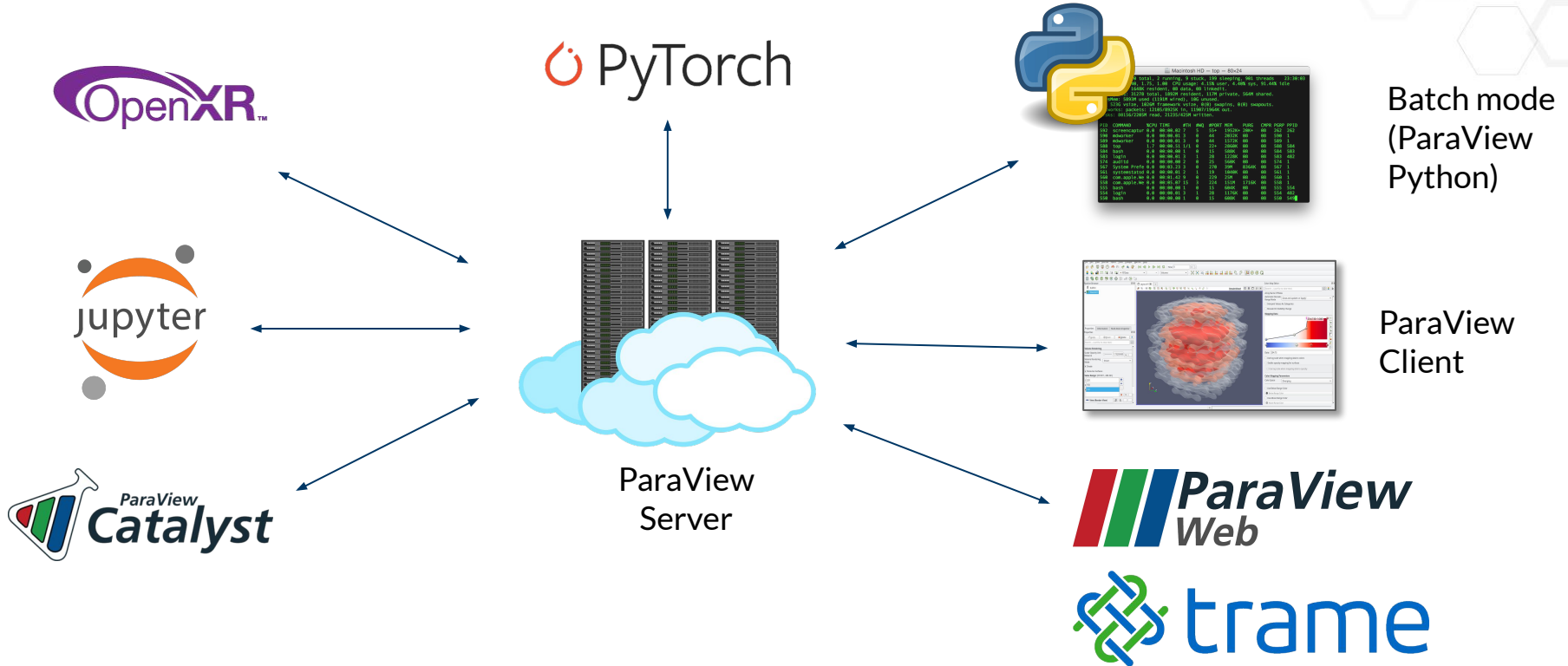
LidarView **A Visualization and Analytics Toolkit**

- Easy to use ParaView-based application with a Graphical User Interface (GUI)
- Real-time open source software to visualize, record and perform analysis of LiDAR data
  - Extensible/Adaptable to Support Various LiDAR and enables vendor specific apps
- Also Allows opening las files (since V4.4.0)
- Continuously evolving toolkit to enhance and improve upon vendor interface, analytics and automation
- VR available for visualization and interaction
- Developed LidarView based applications for LiDAR vendors
- Permissive Open Source Licensing

kitware
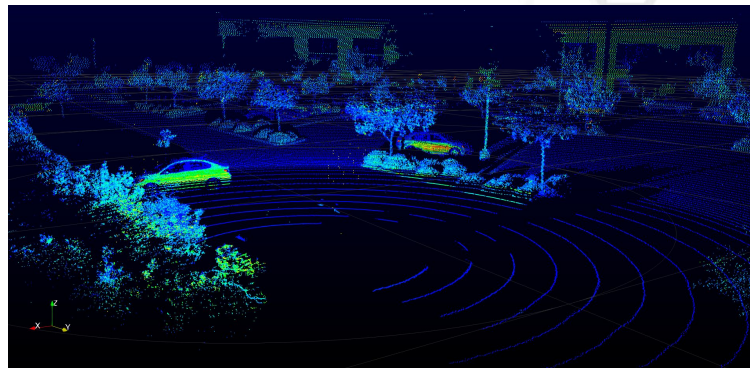
LidarView : Point Cloud processing Capabilities

- SLAM :
  - Enables trajectory estimation and map reconstruction from it
  - Fuses external sensors (IMU,GPS, Wheel Odometer, Camera…) for more robustness, accuracy and point colorization
- Deep Learning
  - Enables usage of DL libraries such as PyTorch, TensorFlow or MMDetection3D toolkit for Deep Learning applications
- Ongoing : Embedding most useful PCL functionalities as filters
- Anything you can think of (on temporal or static data), through Python or C++ implementation thanks for modular interfacing
- Can be done at big scale thanks for Paraview distributed computing capabilities
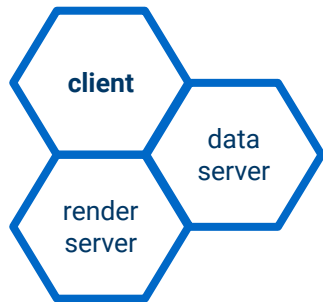

Kitware
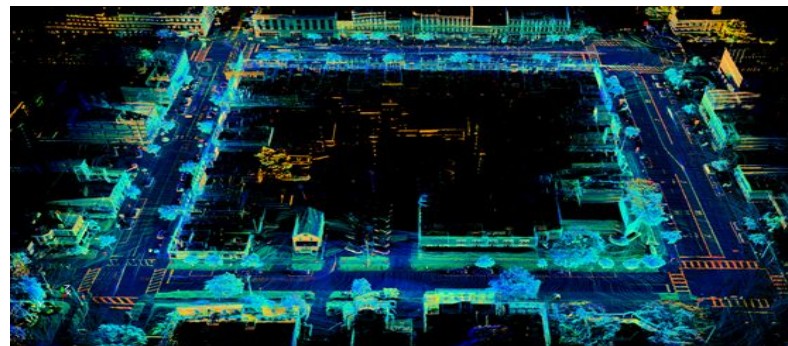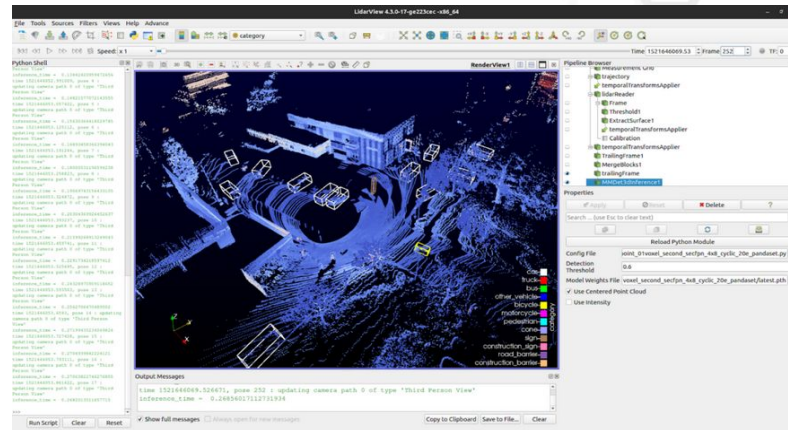
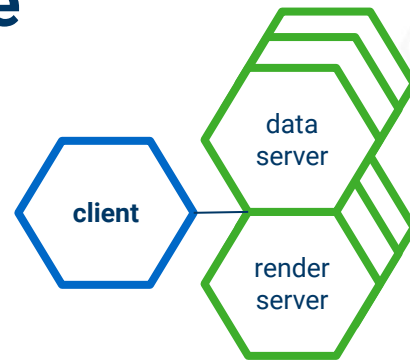# ParaView / LidarView for Distributed computation

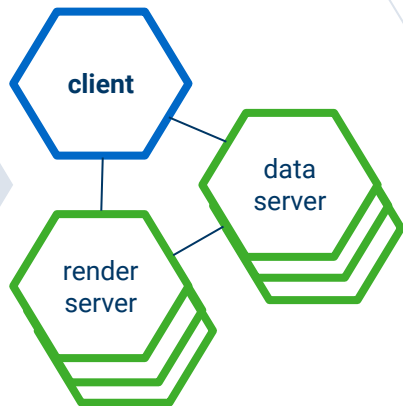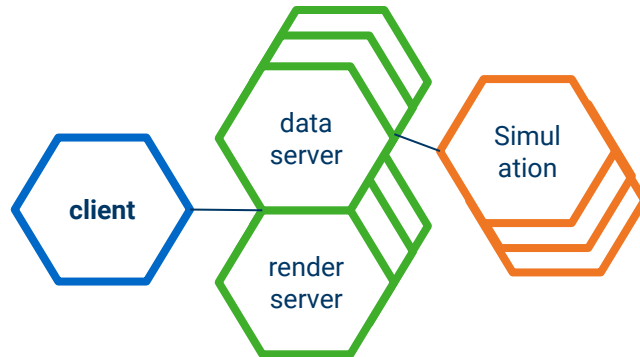# ParaView's Client Server Architecture
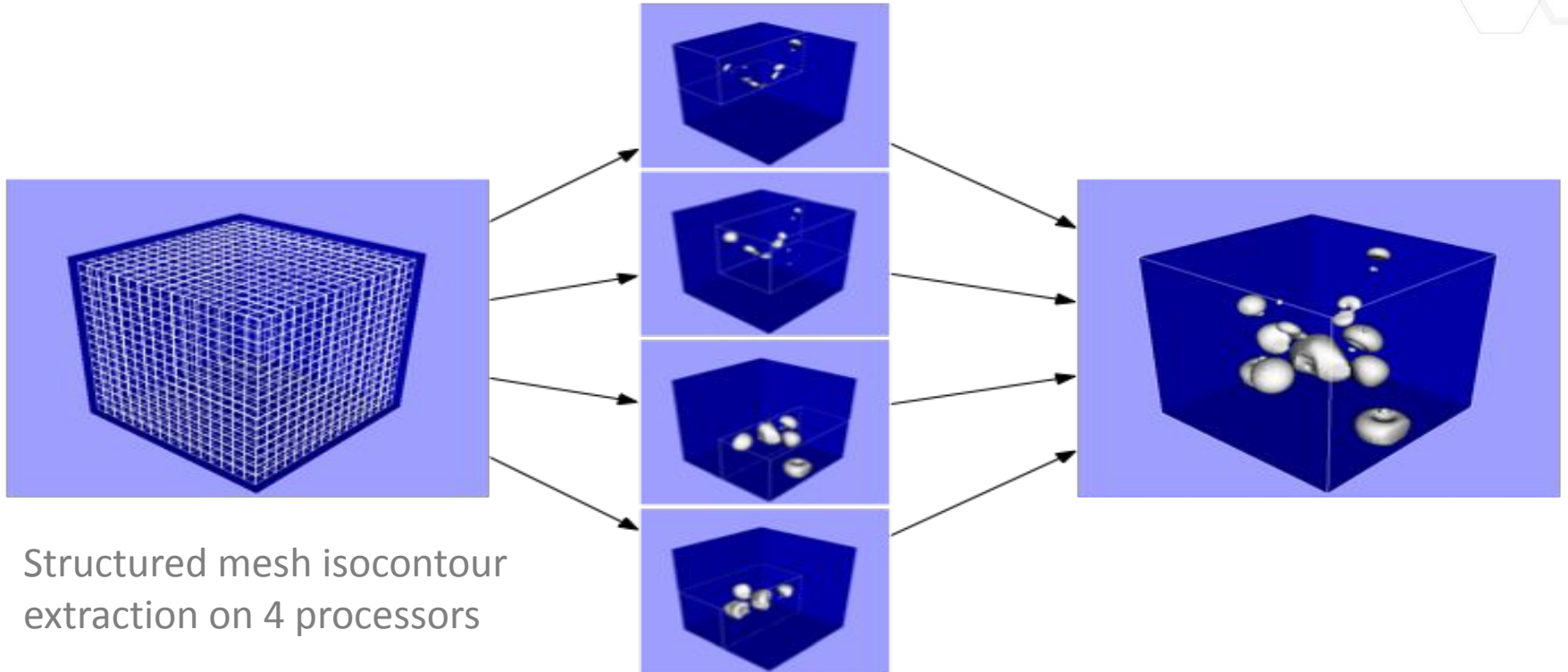

Built-in
paraview

Distributed
pvserver

Graphic Nodes
data/render server

In Situ
catalyst

kitware

ParaView: Distributed Processing of the data

Structured mesh isocontour extraction on 4 processors

kitware

In-situ analysis, with Paraview Catalyst

- **Concurrent** analysis and visualization tasks during simulation
  - Reduce I/O
  - Increase value of stored data
  - Zero-copy analysis
  - Visualization or data reduction can be done at up to each timestep
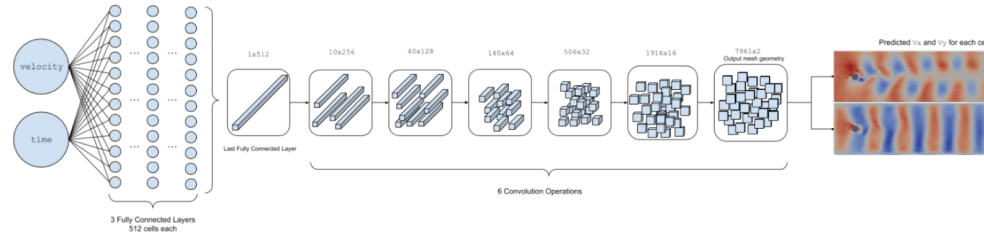   (highly configurable through Python scripting and GUI)

| simulation t0 | analysis | disk | simulation t1 | analysis | disk | ... |
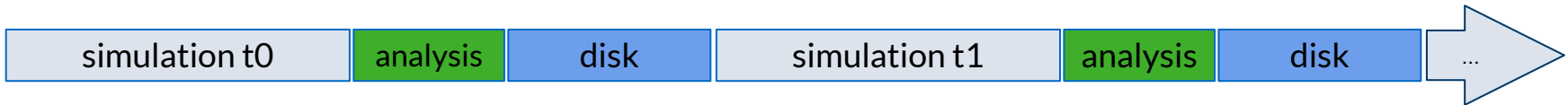
Deep Learning in Paraview

- Goal : Mimic the behavior of a CFD simulation with deep learning to accelerate it (based on EDF's Code Saturne CFD solver)
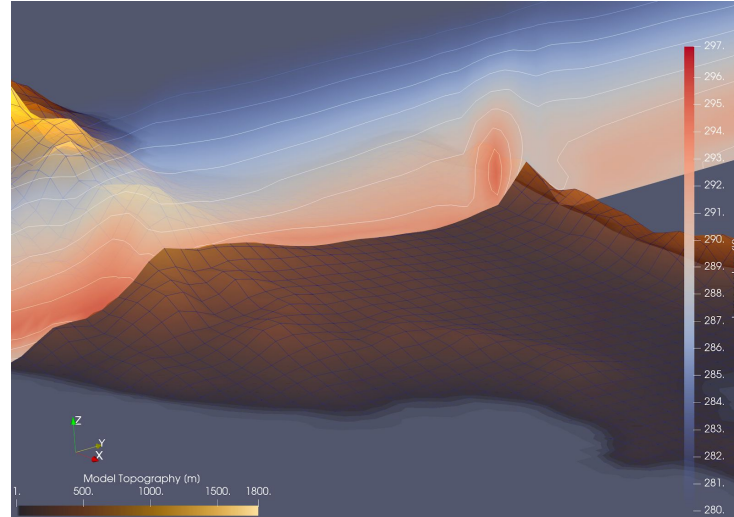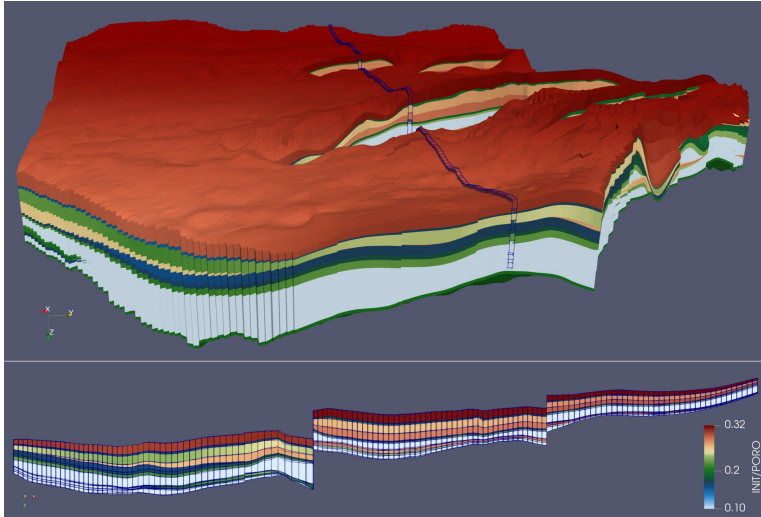- Rendered as it learns in paraview (results and training monitoring)

Kàrmàn Vortex Street surrogate model build with

PyTorch

https://www.kitware.com/deep-learning-surrogate-models-in-paraview-viewing-inference-results-and-monitoring-the-training-process-in-real-time-with-catalyst/

kitware

Some examples of scaled rendering

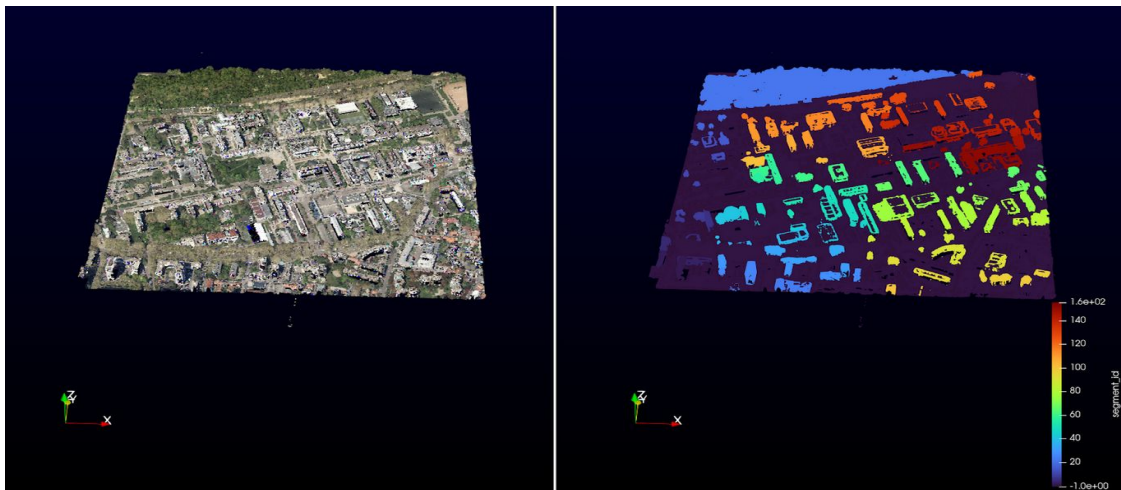# Applications for Aerial LiDAR processing

kitware

Perspective applications for Aerial LiDAR processing : Multimodal point cloud analysis

- Run SLAM algorithm to aggregate map from the ground (potentially colorized)
- Register it to aerial point cloud (based on initial guess from GPS coordinate, refined with ICP like methods)

kitware
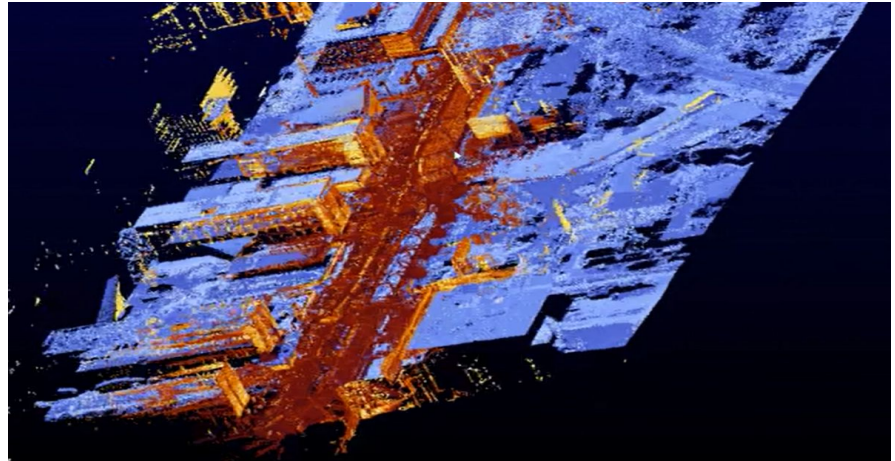
Perspective applications for Aerial LiDAR processing : Unsupervised segmentation and automatic dimension extraction

Use Unsupervised segmentation method on massive data and Extract metrics for each georeferenced object


Left :
RGB visualization in LidarView of las from provided by Grand Lyon (as of 2018)

Right :
Visualization of Segment-lidar (based on Meta's Segment Anything) results, from https://github.com/Yarroudh/segment-lidar

kitware

Perspective applications for Aerial LiDAR processing : Merge with photogrammetry based models

Use lidar scans to improve photogrammetry based reconstruction accuracy
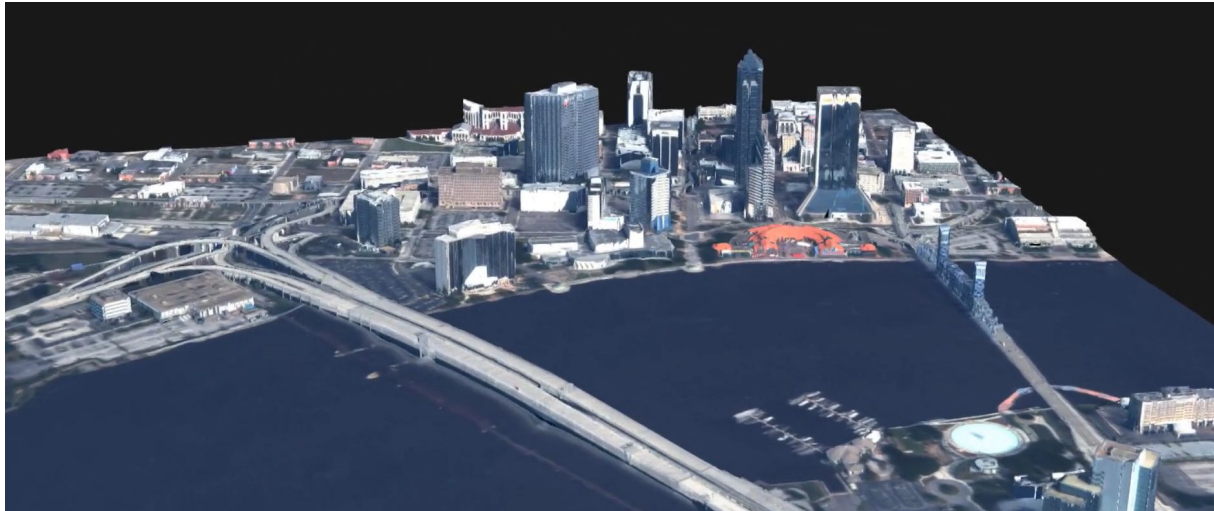
Credits : https://www.kitware.com/3d-reconstruction-from-satellite-images/

ParaView

Take Part in the First ParaView User Day Europe!
Lyon, France - September 19th, 2023

- Inspiring keynotes
- Lightning talks by users
- Kitware one-to-one hands-on sessions
- Demo space
- ParaView dinner (optional)

Join the experience and present!

We understand the value of your expertise, if you want to share with the community, you can submit a presentation title and summary to present during the event.

More Info: https://www.kitware.eu/paraview-user-day-europe-2023/

kitware

cea

TotalEnergies

Thank You!

Kitware Europe

kitware@kitware.eu

+33 437-450-415

kitware