Autonomous systems and Hangar of the Future

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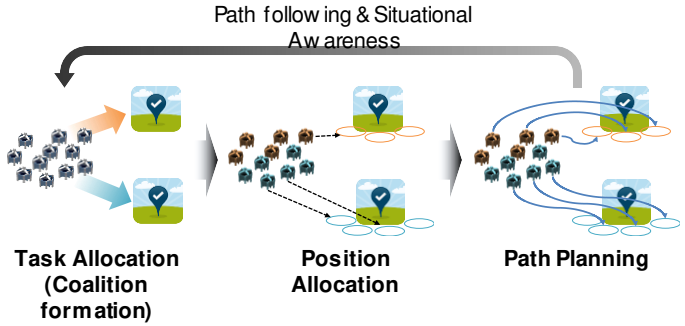
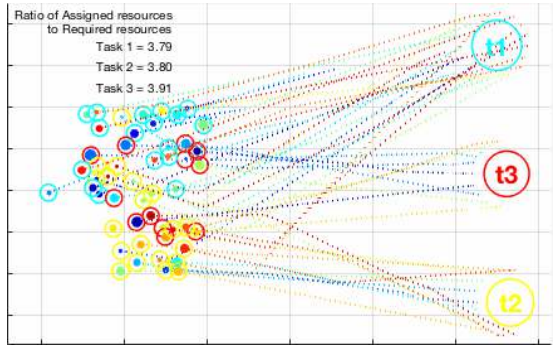
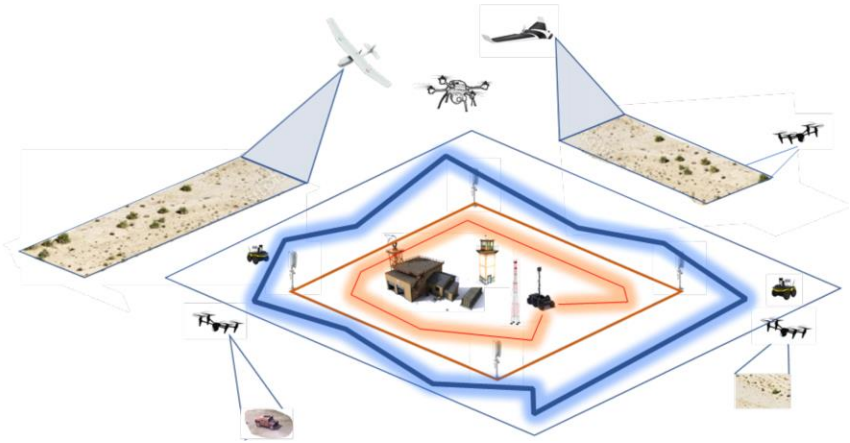
Autonomous Systems

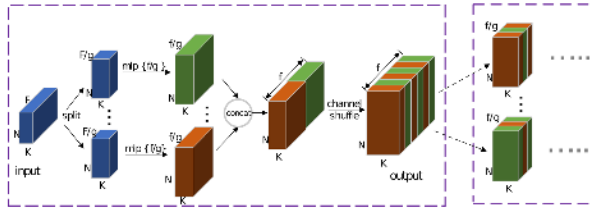
- Perception: detection with deep learning models, multi-target tracking and data association.
- Sensor Fusion architectures (distributed architectures).
- Task allocation.







ShufflePointNet



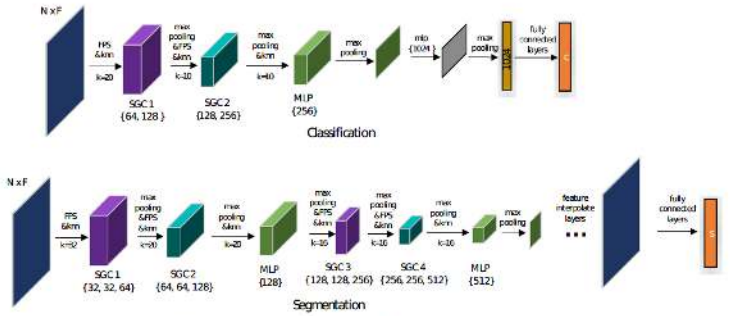
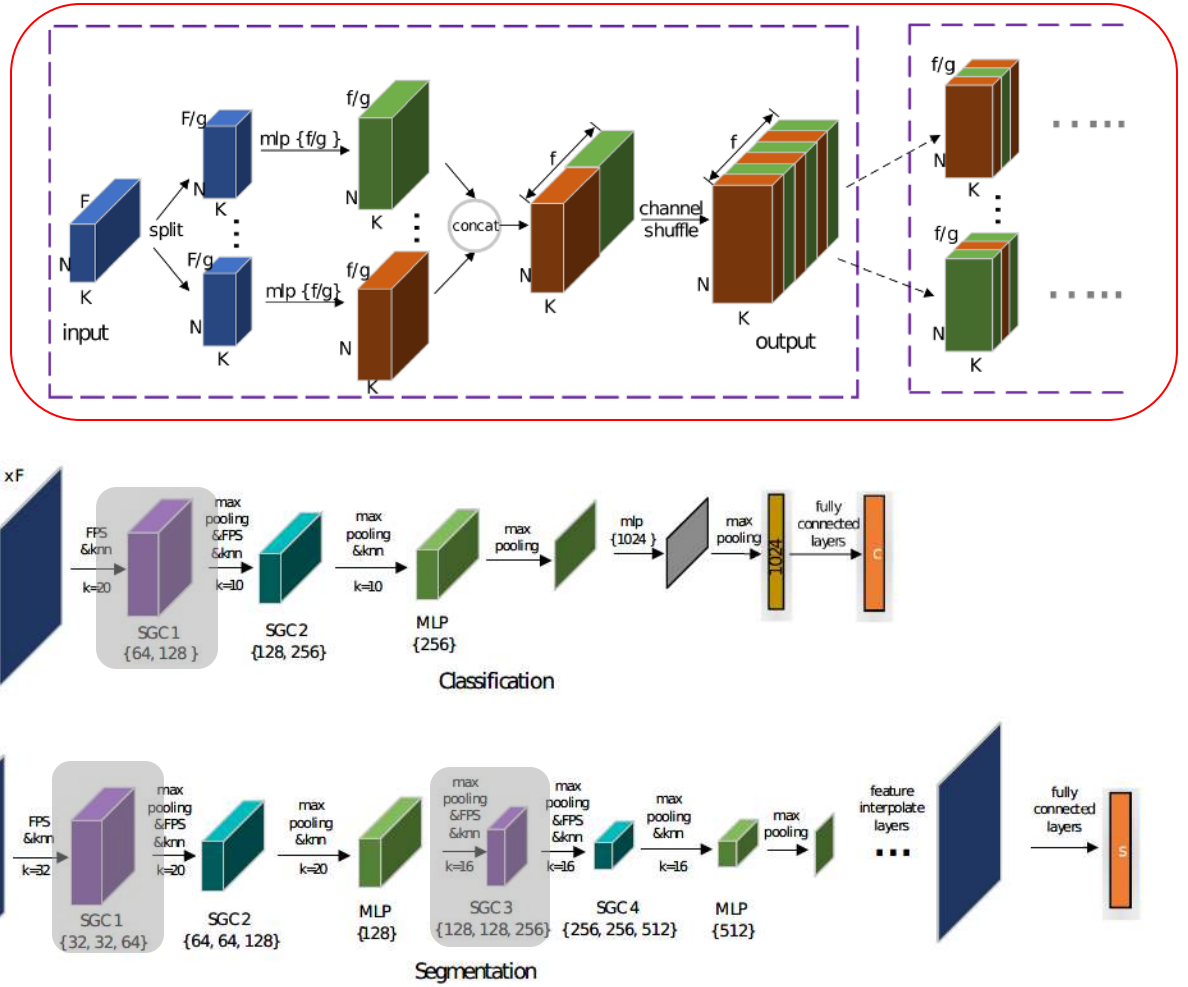


Fig. 3. **ShufflePointNet architecture:** The architecture use *PointNet++* as backbone, and it contains classification structure (top branch) and semantic segmentation structure (bottom branch) for point cloud. In detail, N, F indicates the number of input points, and corresponding feature channels respectively. k is the number of the neighbors. Besides, the number in the brace $\{\}$ indicates the MLP filters.

ShufflePointNet: An Efficient Neural Network for Point Cloud Analysis via Group Convolutions

- ShufflePointNet is an efficient way to process point-cloud data
- Uses the concept of channel shuffle and shuffle layer
- A state-of-the-art deep neural network capable of reaching high-level accuracy for segmentation and classification
- Efficient computational performance



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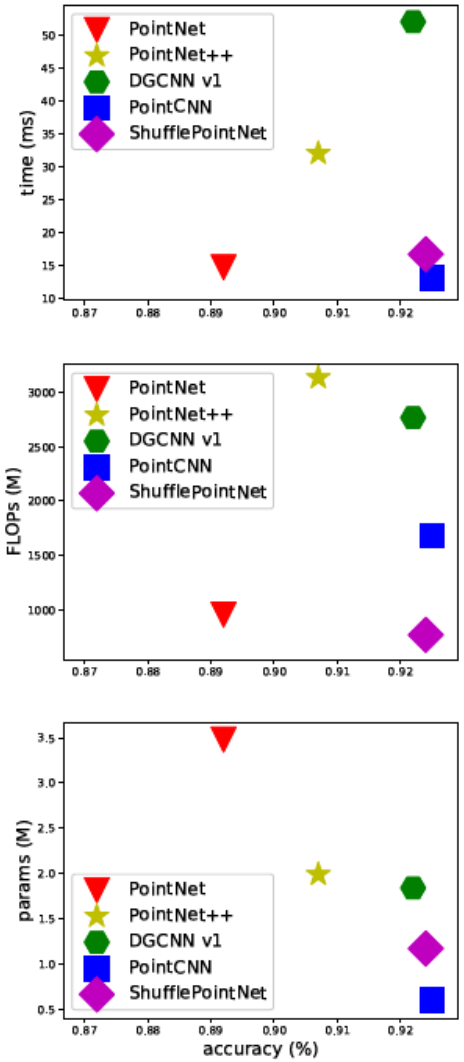
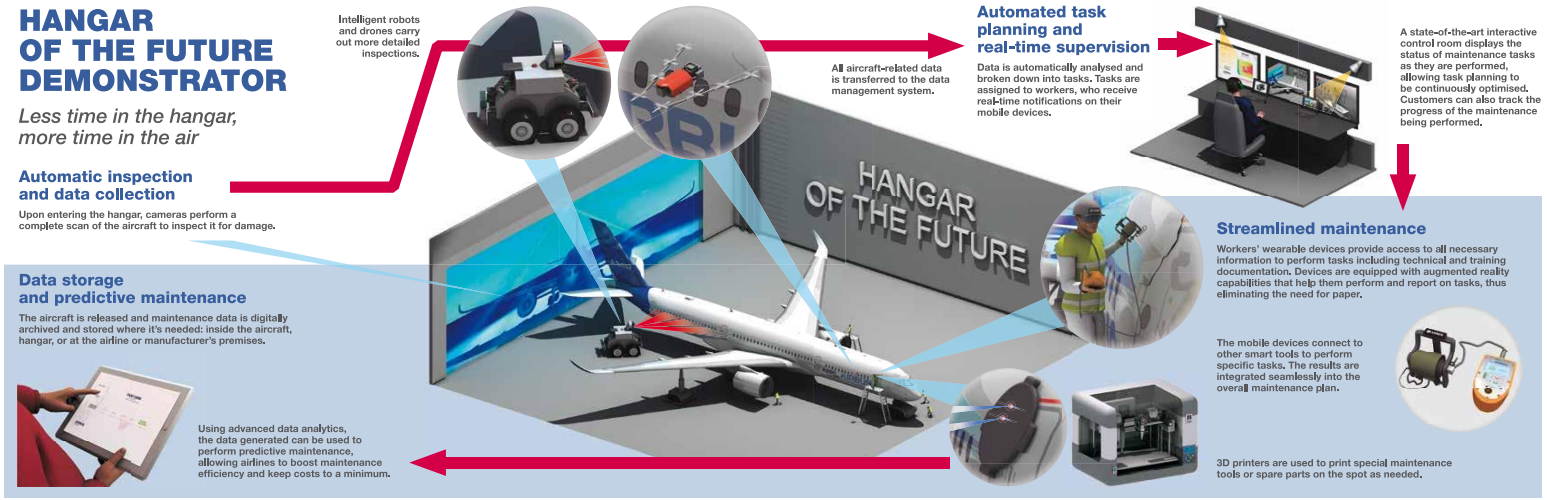


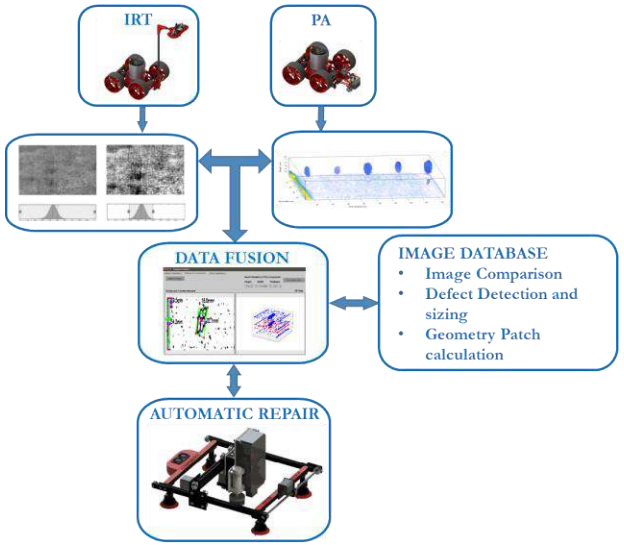
Hangar of the future

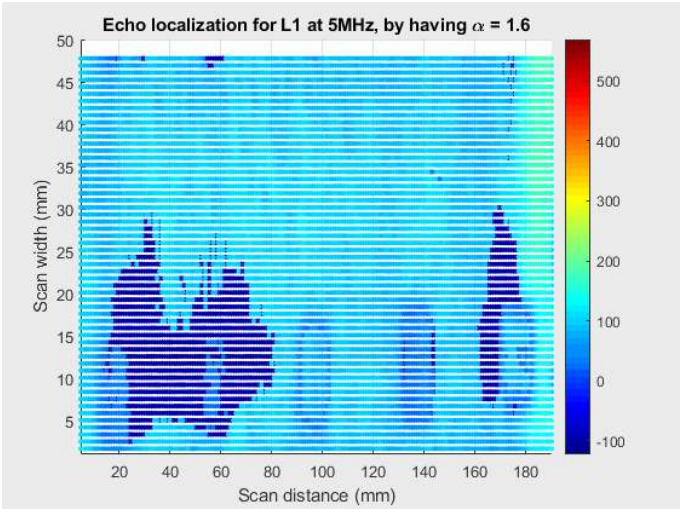
- Automated inspections
- Sensor fusion
- Data analytics
- Predictive maintenance



UAV inspection (using RGB or IRT cameras)

Robo-inspections (Ultrasonic + IRT)





Using data analyse patterns

PROGNOSTICS

- Replacement of unscheduled maintenance by systematic scheduled maintenance
- Replacement of scheduled maintenance by condition based maintenance

MOBILE TOOLS

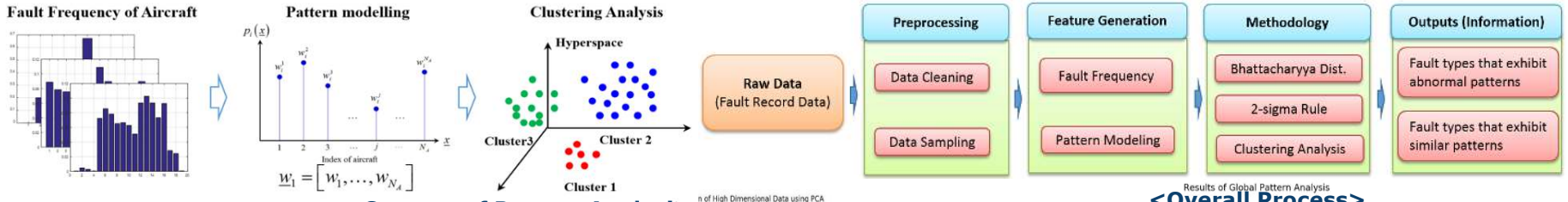
- Contextualised Documentation
- Dispatch assessment
- Augmented/Virtual Reality
- Defects Reporting
- Elapsed time control

COLLABORATIVE ENVIRONMENT

- Configuration management
- Maintenance Planning Optimisation
- Data Analytics
- Knowledge Database

Pattern Analysis

Identify unusual patterns of fault frequency across the fleet aircraft → Early warning for potential issue



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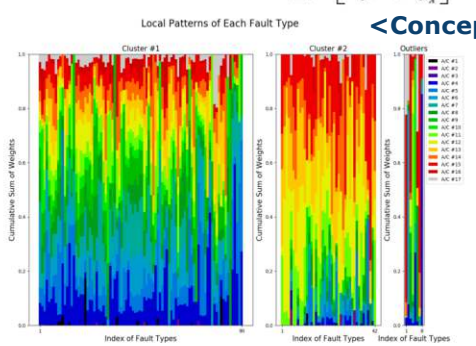

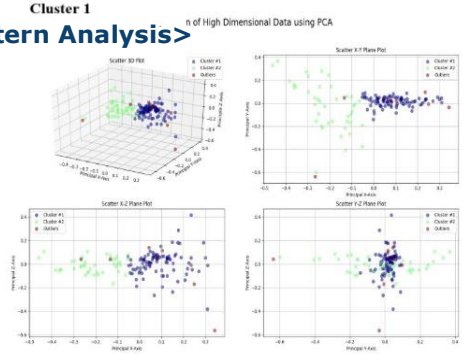

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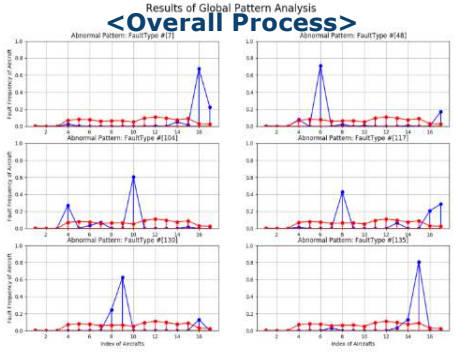
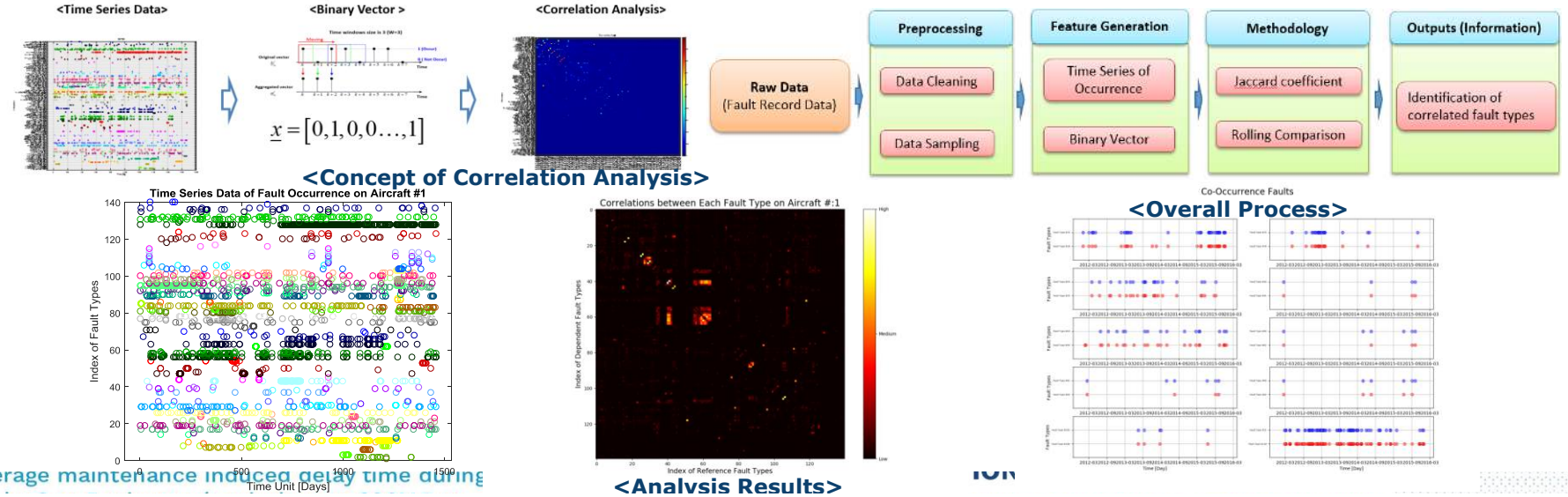


<Overall Process>

Using data to predict failures

Correlation Analysis

Identify correlated fault types in term of occurrence pattern → High-level fault prognosis



Data Mining | Knowledge Based System | K-means algorithm

Machine Learning | Decision Trees | Support Vector Machine

Density-Based Clustering | Self-Organizing Map | Hill Climbing Algorithm