luffy.ai

Adaptive Control for Drones and Robotics

Driving the next generation of intelligent machines.

Time to take control

Pushing the limits

We are witnessing one of the most exciting transformations in aviation since the jet engine was created some 80 years ago. The move to electrification is driving a revolution in vehicle design, whilst the emergence of the drone ecosystem has opened up a whole new range of applications.

However, safety concerns and substantial technology limitations are preventing the widespread commercial use of drones. Reducing the risk that unmanned air system (UAS) operations present to third parties is a key consideration of the Civil Aviation Authority (CAA) and a critical factor in enabling beyond visual line of sight (BVLOS) operations. BVLOS will pave the way to novel drone applications, such as advanced air mobility (AAM), which will truly revolutionise our world.

To realise this future, a new generation of flight control system is required – one that demonstrates improved performance, safety, robustness and autonomy in lightweight, low-cost avionics.

Say hello to Luffy AI

Luffy AI has developed adaptive neural networks that allow real time on-board learning and adaption. Initial results show that Luffy's AI flight controller qualitatively outperforms conventional autopilot controllers, expanding the operating envelope and improving robustness. This opens the field to new classes of drone body, with lower requirements on manufacturing precision, such as modular or improvised drone platforms.

To us, AI means Adaptable Intelligence. Just as nature evolves and adapts, we believe that control systems should have the ability to learn and continually adapt for safe and optimal performance.

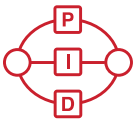
Come rain or shine: exceptionally adaptive and resilient flight control for safer drone operations.

Safer drone operations

The flight controllers used in drone platforms today are typically based on proportional-derivative-integral (PID) technology. Their performance has been optimised in their tuning region but quickly deteriorates when the vehicle is exposed to unknown dynamics (e.g., wind, dynamic payloads, component failure).

Adaptive AI has unlocked unprecedented opportunities for flight control. Adaptive neural networks have the potential to dramatically improve vehicle robustness, performance and operational safety.

Standard flight controller:



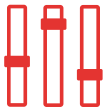
Limited flight performance

Use of simple cascaded PID systems limits the flight performance to the tuning of the vehicle. Changing payloads requires compromises in control settings.

Low robustness and fault tolerance

Not robust to disturbances failure modes. Common failure modes can lead to a complete loss of control, even if the vehicle could theoretically recover.

Adaptive AI flight controller:



Increased robustness

Automatic tuning to the vehicle. Adapts to variations in wind conditions, payload and centre of mass.

Improved safety and fault tolerance

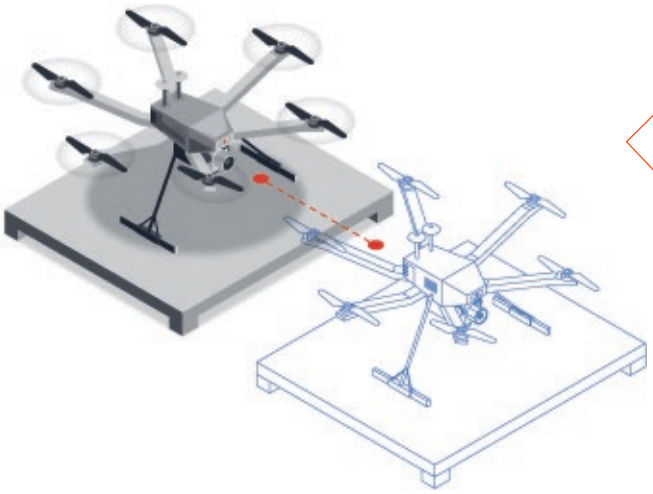
Graceful degradation when propellers are damaged, or body compromised.

Power efficient

Needs very little onboard processing power (under 10% of one core of a Raspberry PI 4).

How does Luffy AI work?

Here's how Luffy AI develops flight control systems with the ability to adapt in real time.

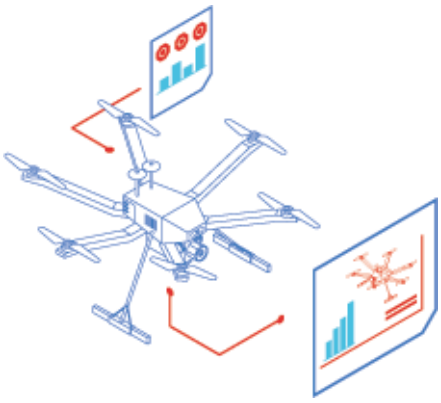


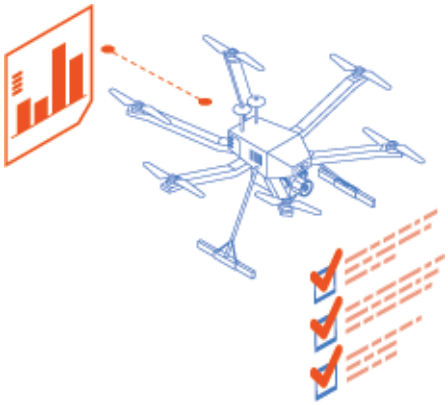
1

First, we develop a digital twin of your drone platform. This replicates your vehicle in a virtual environment, including its key features and dynamic characteristics.

In this virtual environment, we develop and train our adaptive AI control, simulating thousands of scenarios, in order to expand the scope of your hardware's operation.

2





3

Running simulations for different scenarios, we validate the improved flight characteristics of your vehicle, ensuring safety and operational performance.

Finally, when deployed, our cutting-edge robust AI algorithms continuously adapt at the edge, fine-tuning and optimising the flight performance of your drone platform.

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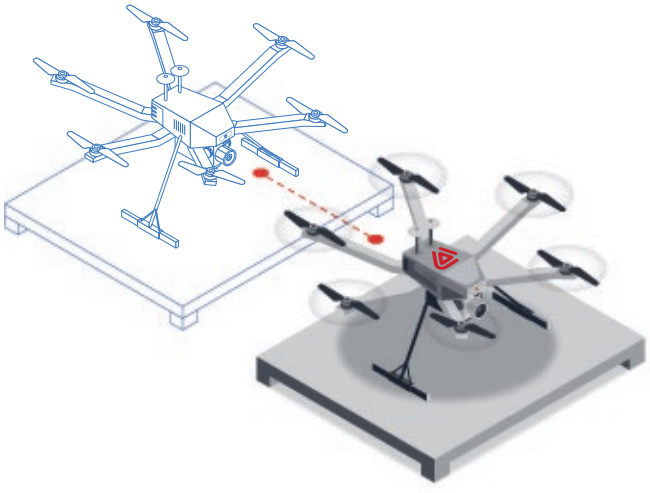
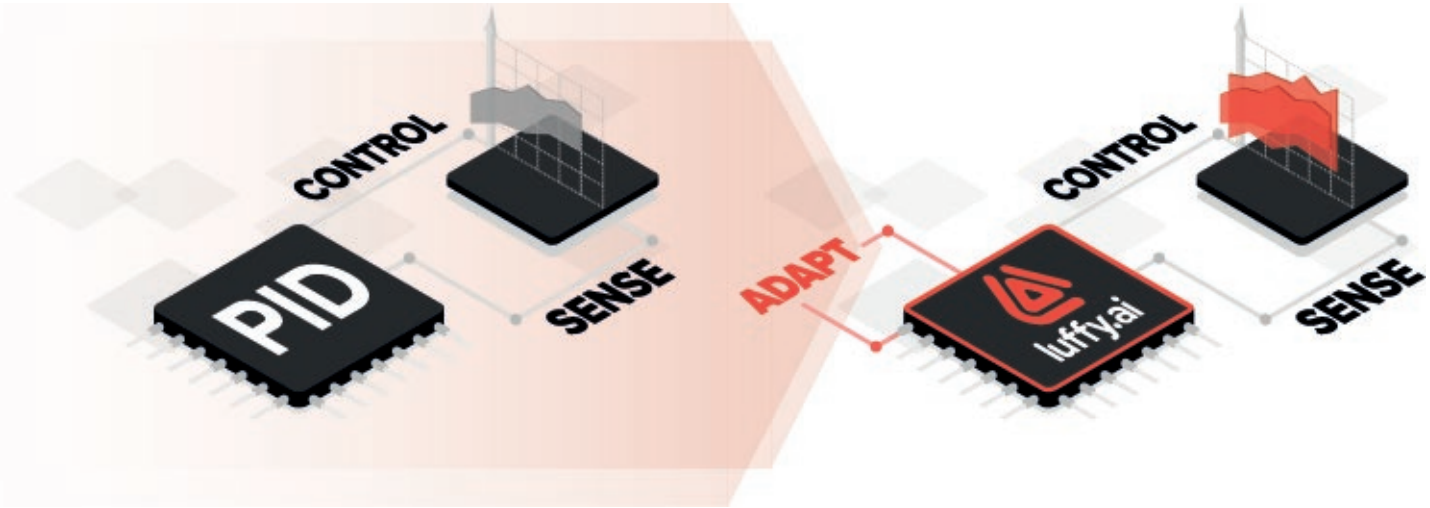


Scalable and rapid to deploy, our adaptive neural controllers can be a drop-in replacement for your existing PID architecture.

Bridging the technology gap: differentiation with game-changing capability.

The power of adaptive intelligence

Luffy brings a radically new approach to control. Our adaptive AI technology is able to expand the operating envelope of your vehicle. Adaptive Intelligence allows your system to be more resilient when exposed to unexpected dynamics and enables new modes of operation.



What makes us different?

	Conventional AI	Classic Control (PID)	luffy.ai
Suitable for control applications	✓	✓	✓
Scalable to big control problems	Limited	-	✓
Suitable for computing at the edge	-	✓	✓
Networks can transfer from simulation to reality	-	n/a	✓
Explainable training curriculum	-	n/a	✓
Continuous adaptation	-	-	✓

What does working with us involve?

From customisation to integration of the control network on your platform, we work with you each step of the way.

Here's what you can expect when working with us.

✔ Discovery

We begin by taking the time to understand your technical and commercial scope, including key value drivers and pain points. Once these have been identified, we determine where AI can achieve the greatest impact, documented in a full proposal.

✔ AI development

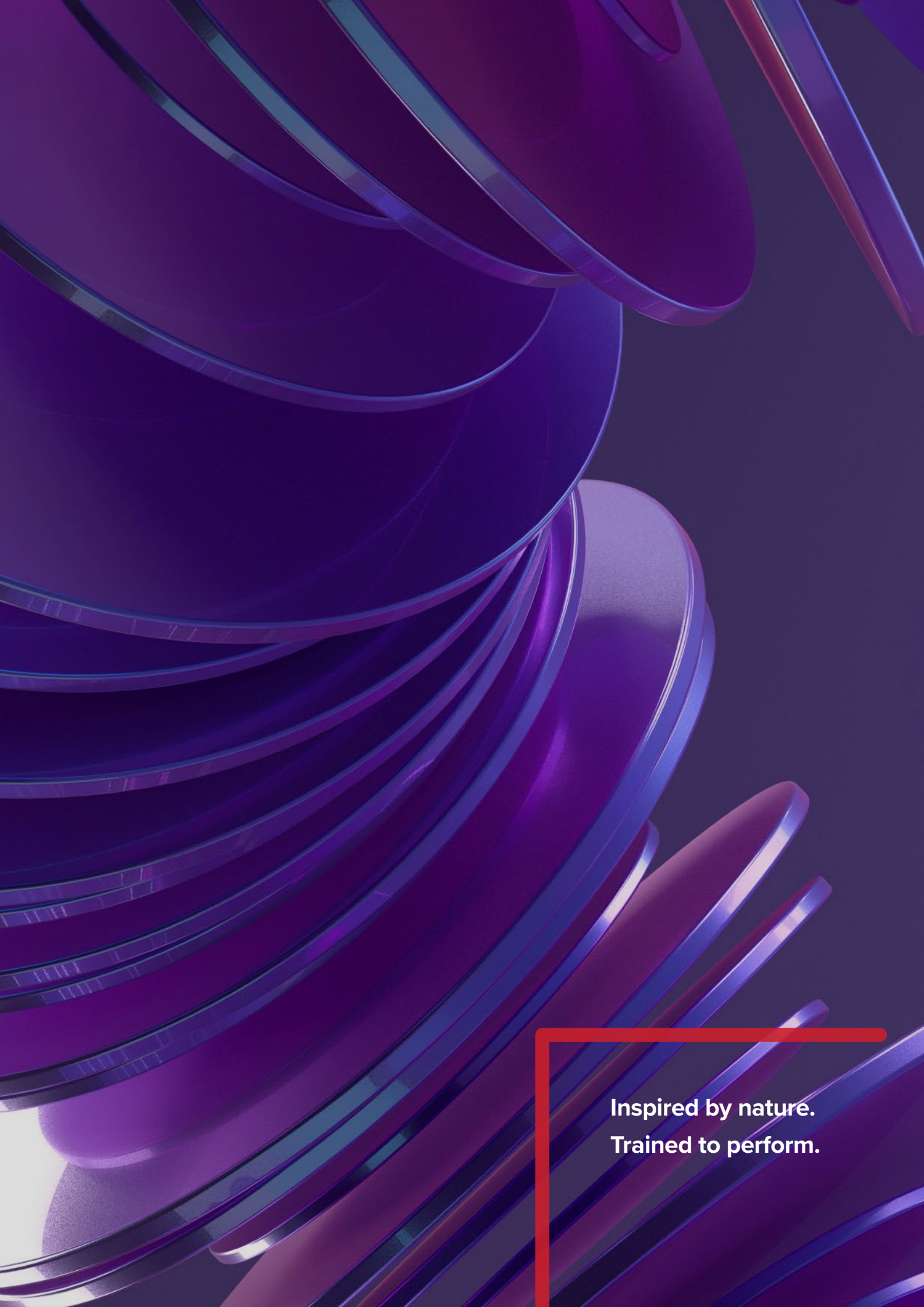
Next, we develop the physics engine to simulate your vehicle – developing, training, validating and demonstrating our AI control software in this virtual environment. We also work with you to prepare the software and hardware required for integration in your existing platform.

✔ Physical trial

The next step is to install the adaptive flight controller in your selected trial vehicle and test controller performance. Now we can demonstrate real-world results!

✔ Deployment

With verified real world results, our AI controllers are ready to be deployed across your fleet. Congratulations!


Inspired by nature.
Trained to perform.

Enabling tomorrow's sustainable manufacturing and robotics through the development of revolutionary adaptive AI control systems.

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