Soft Robotics & AI — 15 Minute Script for Two Speakers

Slide 1 — Title (30s)

Speaker 1:

Hello everyone, welcome to our talk on Soft Robotics and AI.

I'm [Name], and this is [Partner's Name]. Today, we'll show you how bio-inspired ideas, especially soft robotics, combine with AI to create robots that are adaptive, safe, and intelligent.

Slide 2 — Motivation (1.5 min)

Speaker 2:

Rigid robots are great in factories — precise and strong. But in messy, unstructured environments, they fail. Think about trying to pick up an egg with a rigid gripper — it will break.

Nature solves this with soft, deformable bodies. Octopuses, elephant trunks, and starfish can grip, bend, and adapt to their environments with ease.

This is where AI comes in: controlling a soft body is very complex, and traditional control methods often fail. So we use AI to help robots learn how to adapt, just like biological systems.

Slide 3 — What is Soft Robotics? (1.5 min)

Speaker 1:

Soft robotics uses materials like silicone, elastomers, or textiles instead of metal. These robots are flexible, safe for interaction with humans, and adaptive in unpredictable settings.

A key advantage is something called morphological computation: the body itself helps with problem-solving. For example, a compliant gripper naturally conforms to an object without needing precise control.

This makes soft robots ideal for fields like healthcare, agriculture, and even underwater exploration.

Slide 4 — Why AI is Needed (1.5 min)

Speaker 2:

Here's the challenge: soft bodies are difficult to model. Their motion is nonlinear and hard to capture with equations.

Traditional control methods like PID struggle here.

So we use AI:

- Reinforcement Learning lets robots learn by trial and error.

- Evolutionary algorithms can optimize both the robot's body and its controller.

- Differentiable simulation allows end-to-end training where gradients can flow through physics models.

Slide 5 — Case Study: Soft Finger Gym (2 min)

Speaker 1:

One exciting example is the ETH Zürich Soft Robotics Lab's SoftFinger Gym.

It's a PyBullet simulation environment that models soft robotic fingers and arms. Researchers use AI frameworks like Stable Baselines to train policies.

This setup allows us to test AI-driven soft robots in simulation before building them in hardware. It lowers cost and speeds up innovation.

In the demo plan, we'll show you how to run a simple SoftFinger environment, train or load an RL policy, and watch how the finger bends and adapts to tasks.

Slide 6 — Demo Plan (1 min)

Speaker 2:

Here's what the demo looks like in practice:

1. Clone the repository and install dependencies.

2. Run the SoftFinger-v0 environment in PyBullet.

3. Train or load a reinforcement learning policy.

4. Observe the finger adapt and manipulate objects.

This shows how AI learns to handle the complexity of soft bodies, something that's nearly impossible with handcrafted control laws.

Slide 7 — Results (1 min)

Speaker 1:

The results are impressive. The AI learns to control the finger effectively, adapting to different tasks — grasping, pushing, or even simple locomotion.

This highlights how body and brain co-design leads to emergent intelligence, just like in biology.

Slide 8 — Challenges (1 min)

Speaker 2:

Of course, challenges remain.

- First, the sim-to-real gap: what works in simulation doesn't always work in the physical world.

- Second, material durability: soft materials fatigue faster than rigid ones.

- Third, reinforcement learning training times can be very long.

Overcoming these is key for practical deployment.

Slide 9 — Future Directions (2 min)

Speaker 1:

Looking ahead:

- Differentiable soft-body physics could make training much faster.

- AI could help co-design the body and controller together.

- Medical robotics could use soft catheters or surgical tools.

- Environmental applications include soft underwater robots inspired by jellyfish.

Speaker 2:

These directions highlight how biology continues to inspire new forms of robotics, and how AI unlocks their potential.

Slide 10 — Conclusion (1 min)

Speaker 1:

To wrap up: soft robotics are safe, adaptive, and bio-inspired.

Speaker 2:

And AI makes it possible to control them effectively. Together, they create robots that can truly move and adapt like nature.

Both:

Thank you for listening. We'd love to take your questions.

Timing Breakdown:

- Intro + Motivation: 2 min

- Soft Robotics + Why AI: 3 min

- Case Study + Demo: 3 min

- Results + Challenges: 2 min

- Future + Conclusion: 3–4 min

Total: ~15 min