

The background features a light gray field with several thin, curved lines, some solid and some dashed, creating a sense of motion or flow. A large, solid red speech bubble is positioned in the center, pointing downwards. The text is white and centered within the bubble.

# Applications of Control and Pattern Recognition in Soft Computing



## Applications in Control – Fuzzy Logic

- Washing machines – adjust wash time & water level.
- Air conditioners – comfort-based temperature control.
- Traffic signals – adaptive timing based on density.



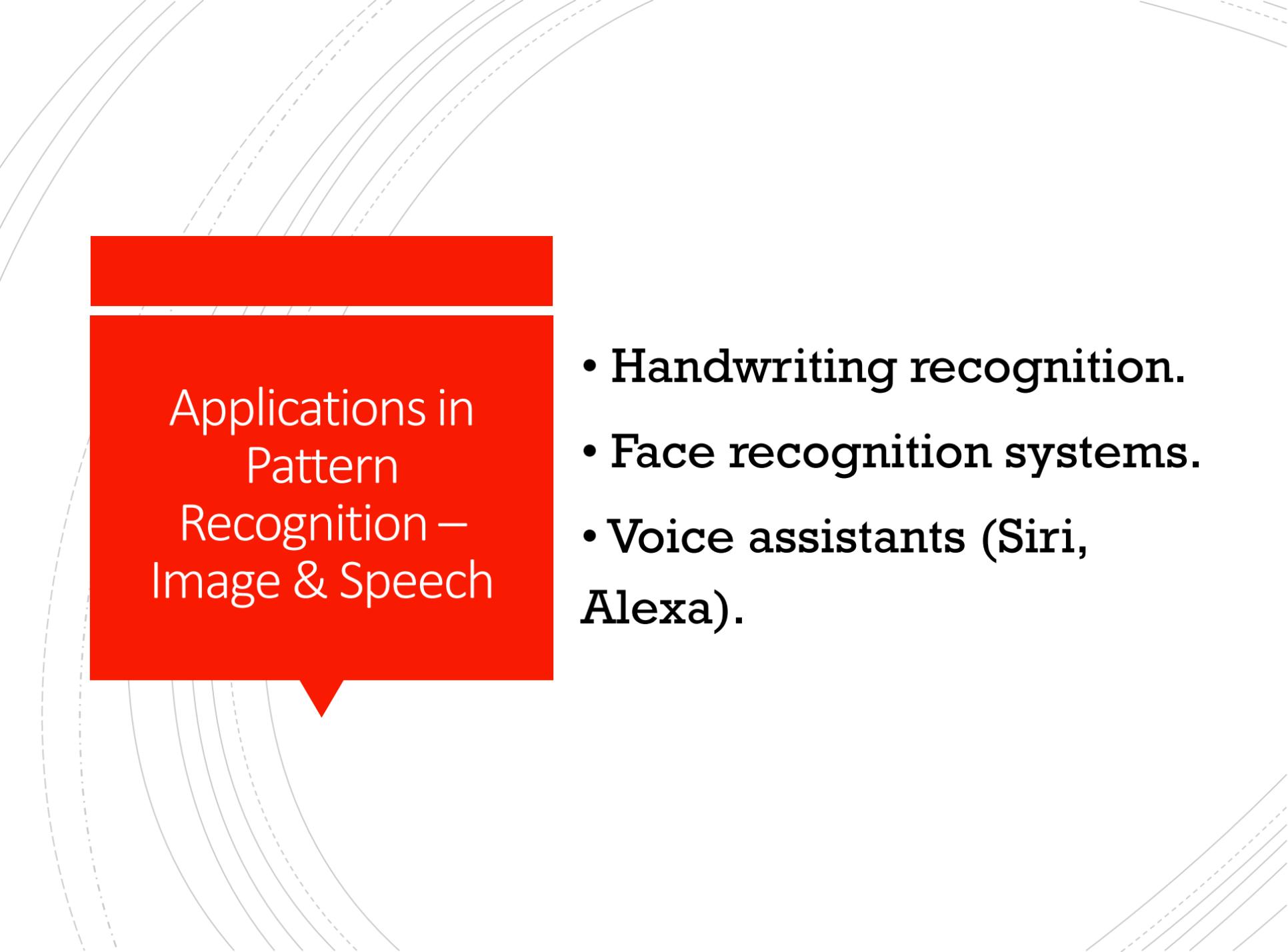
## Applications in Control – Neural Networks

- **Robotics – motion planning & real-time control.**
- **Industrial automation – nonlinear process control.**
- **Aircraft/spacecraft – flight control & autopilot systems.**



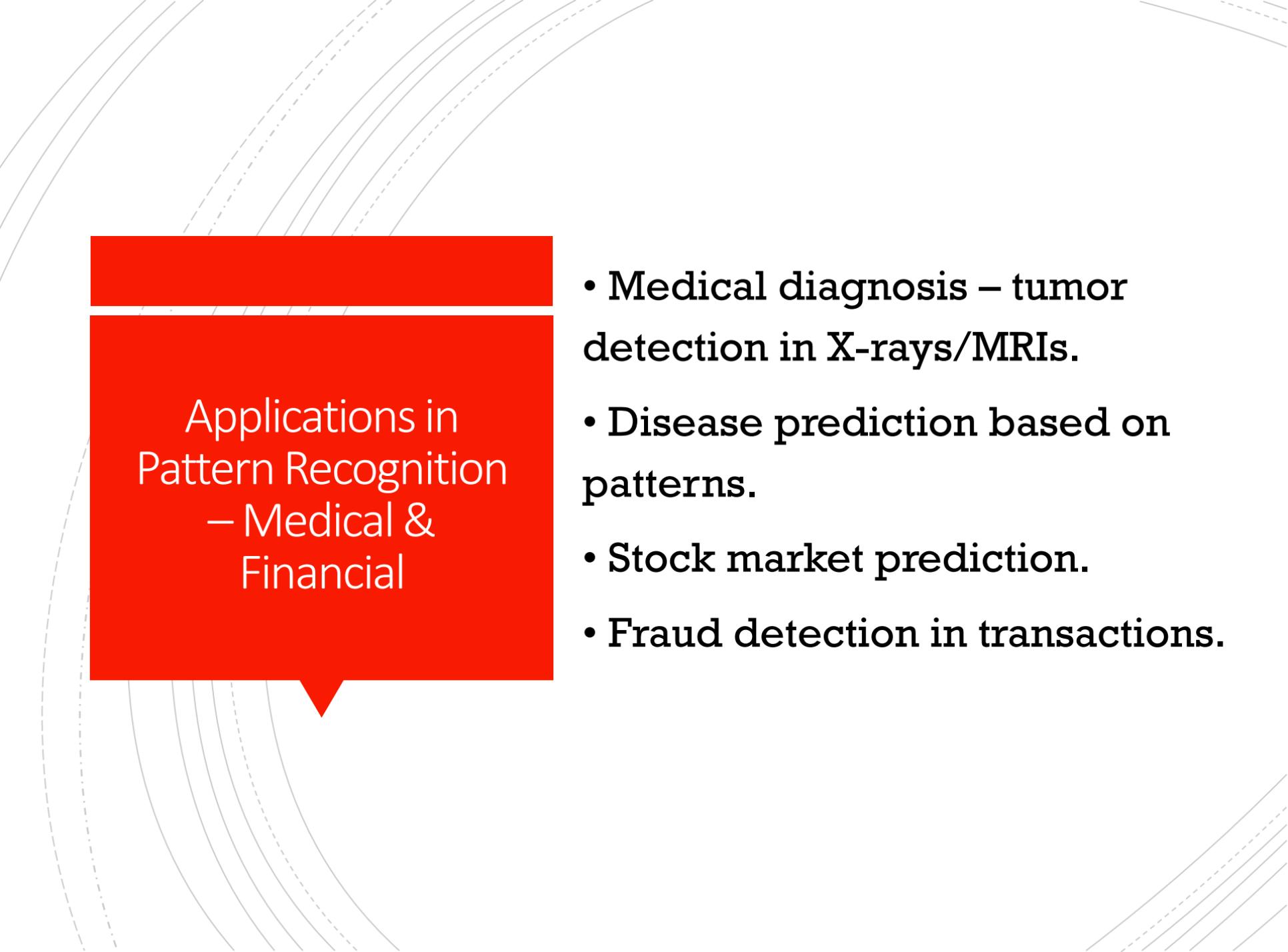
## Applications in Control – GA & Hybrid Systems

- PID tuning using Genetic Algorithms.
- Optimization of system performance.
- Neuro-fuzzy controllers – cars (gear shifting, ABS braking).



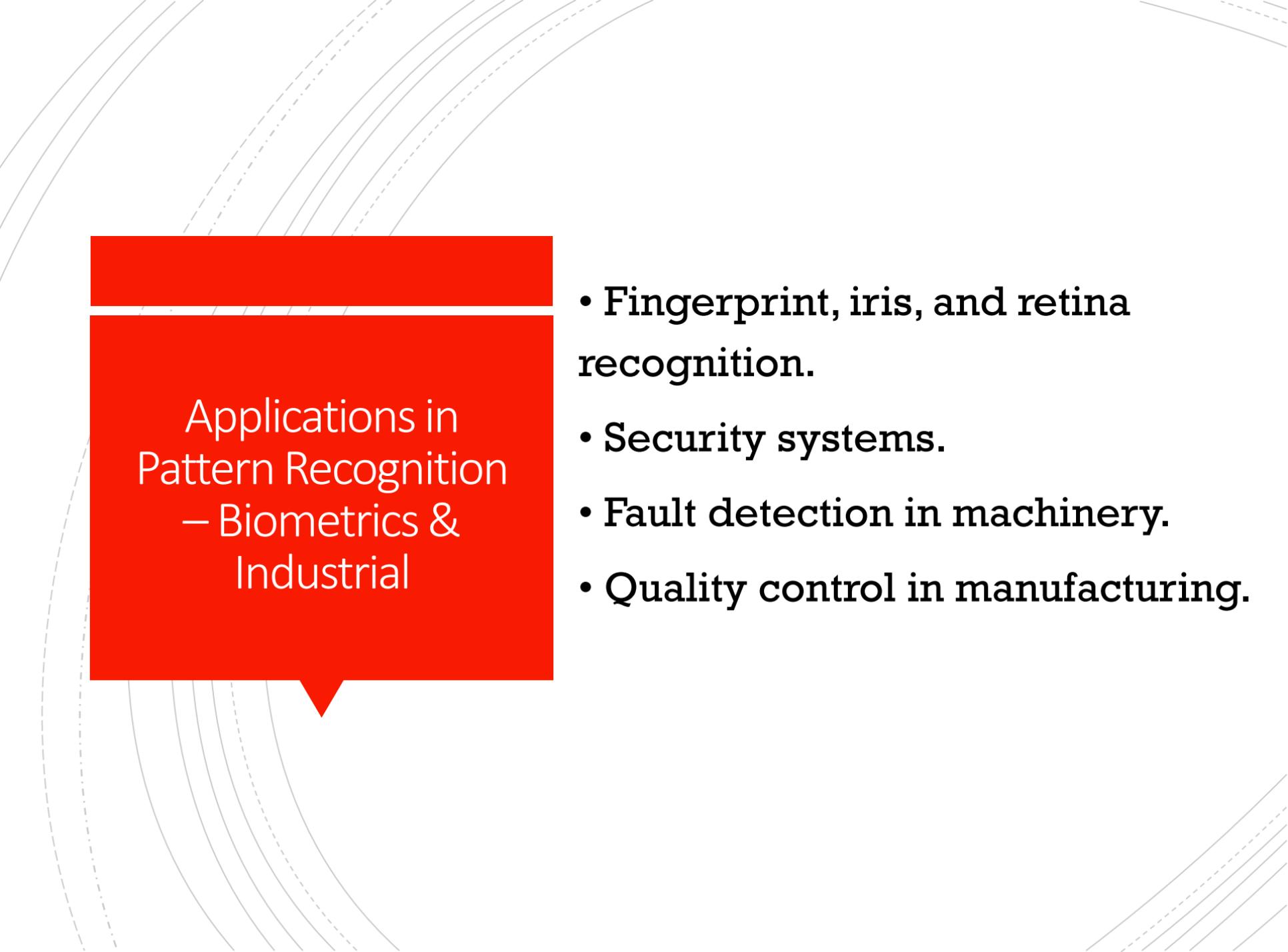
Applications in  
Pattern  
Recognition –  
Image & Speech

- **Handwriting recognition.**
- **Face recognition systems.**
- **Voice assistants (Siri, Alexa).**



Applications in  
Pattern Recognition  
– Medical &  
Financial

- Medical diagnosis – tumor detection in X-rays/MRIs.
- Disease prediction based on patterns.
- Stock market prediction.
- Fraud detection in transactions.



Applications in  
Pattern Recognition  
– Biometrics &  
Industrial

- Fingerprint, iris, and retina recognition.
- Security systems.
- Fault detection in machinery.
- Quality control in manufacturing.



## Comparative Advantages of Soft Computing

- Handles uncertainty & imprecision.
- Learns & adapts to new data.
- Better performance in nonlinear, complex systems.
- More human-like reasoning.

A red speech bubble graphic with a white outline, pointing downwards. It contains the text "Real-Life Applications" in white. The background of the slide features faint, curved, concentric lines in a light gray color.

## Real-Life Applications

- **Smart washing machines.**
- **Self-driving cars.**
- **Healthcare AI (diagnosis, monitoring).**



## Challenges & Future Trends

- Requires large data for training.
- High computational cost.
- Integration with IoT & Big Data.
- Growth in autonomous systems & healthcare AI.



## Conclusion

- **Soft computing enhances control and pattern recognition.**
- **Fuzzy, neural, and genetic methods improve adaptability.**
- **Crucial in AI, automation, healthcare, and security.**