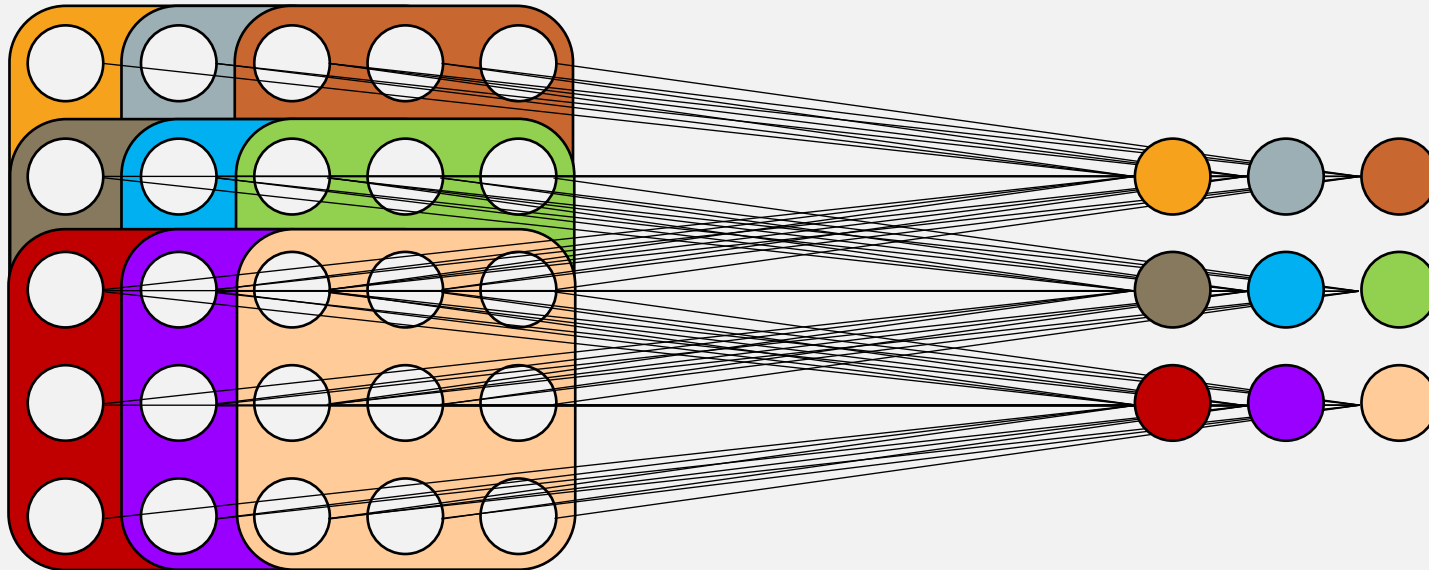


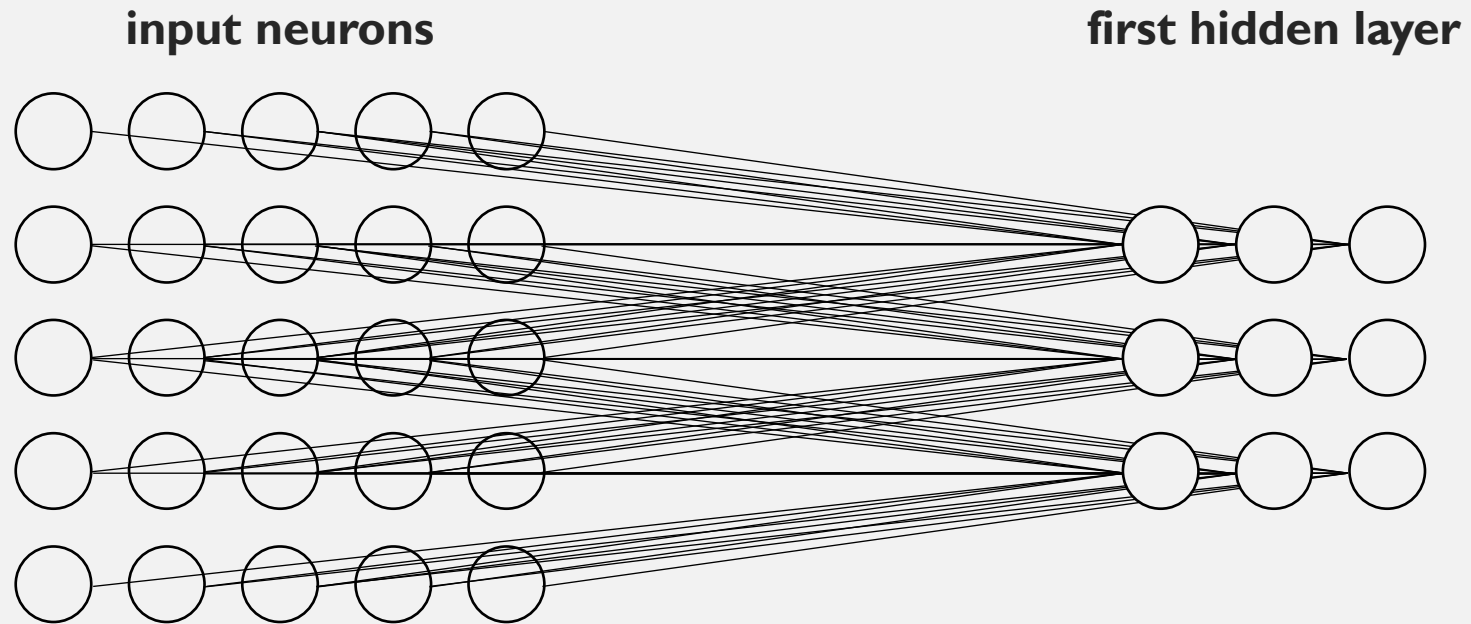
# PERSPECTIVES IN ARTIFICIAL INTELLIGENCE

Lecture 12  
MALI, 2024

# CONVOLUTIONAL NEURAL NETWORKS

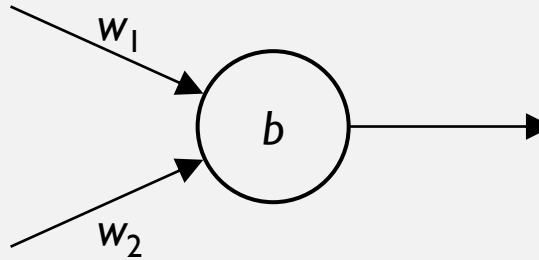


# CONVOLUTIONAL NEURAL NETWORKS

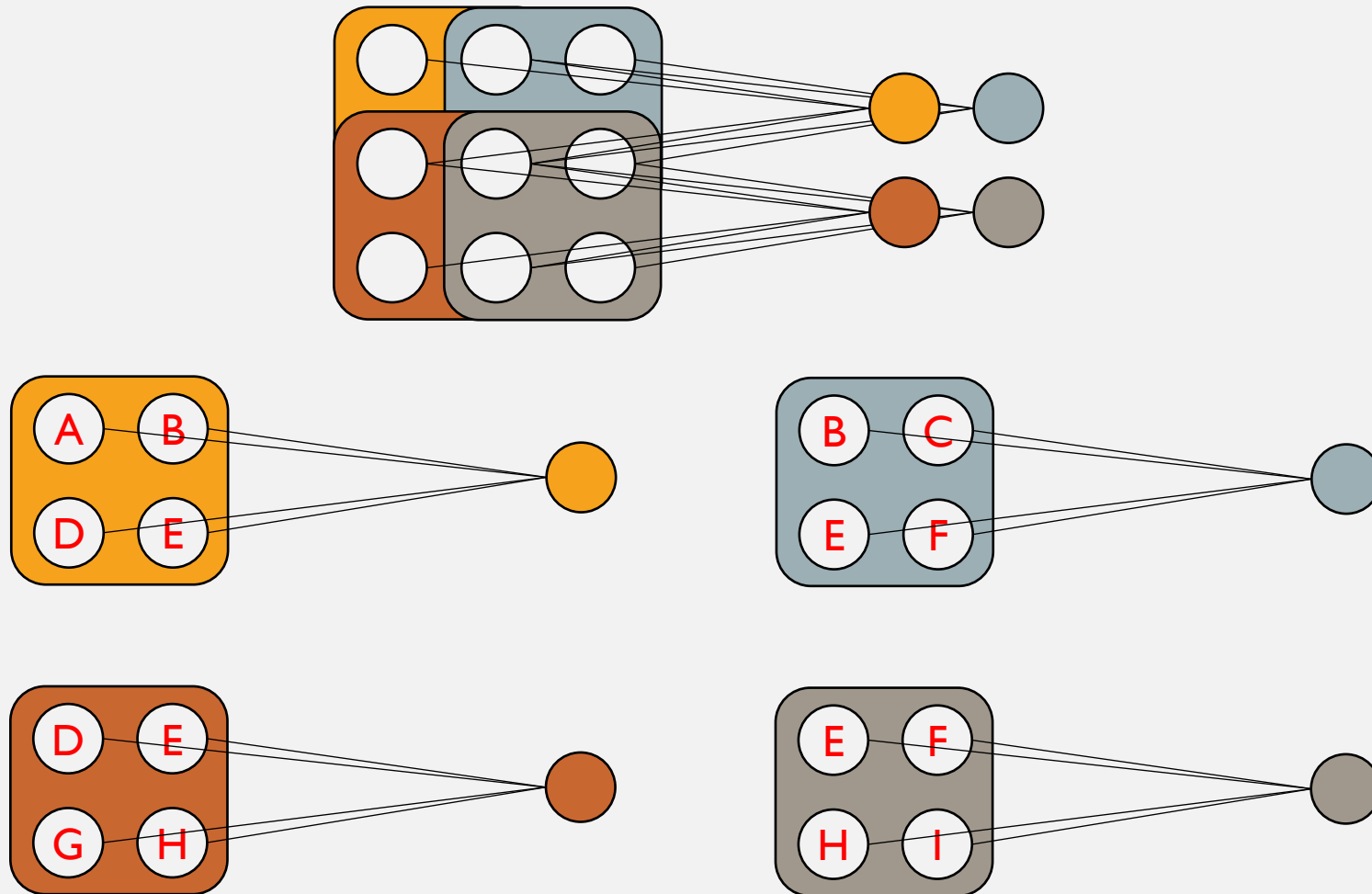


# CONVOLUTIONAL NEURAL NETWORKS

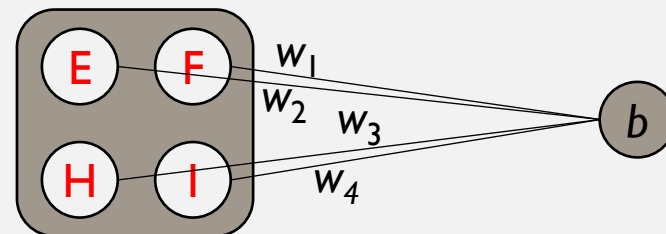
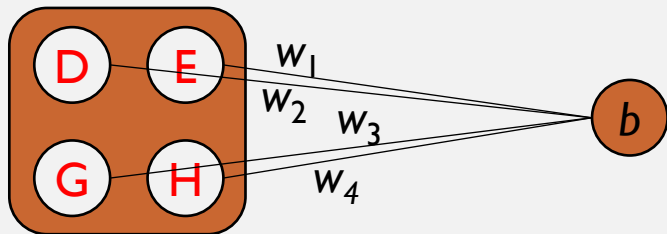
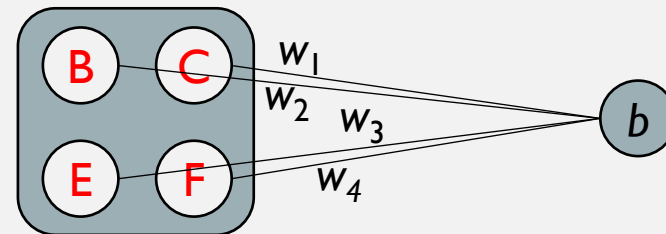
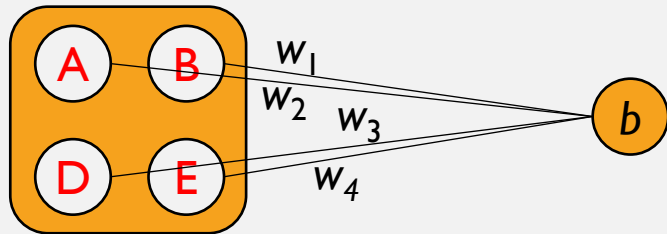
**Remember this?**



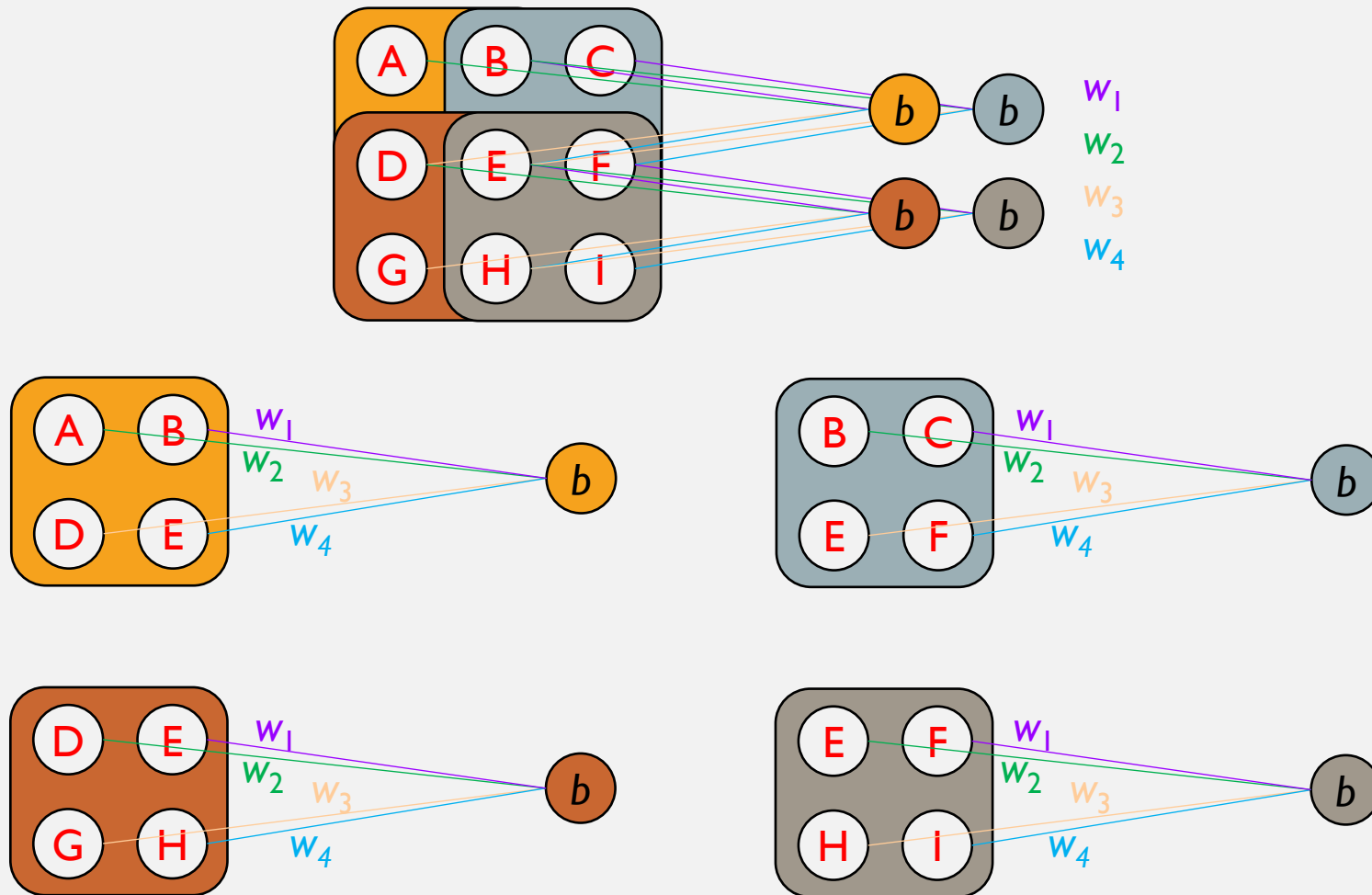
# CONVOLUTIONAL NEURAL NETWORKS



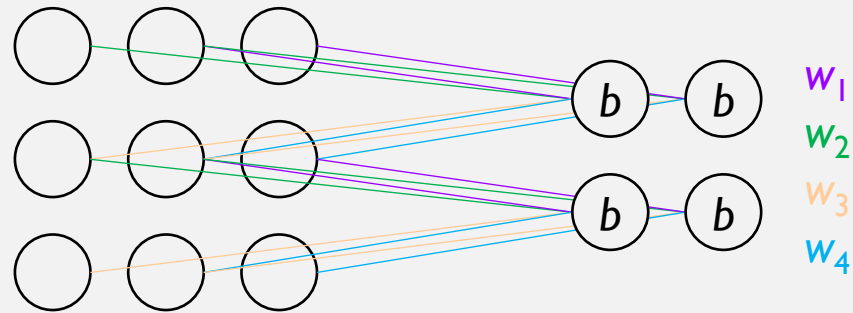
# CONVOLUTIONAL NEURAL NETWORKS



# CONVOLUTIONAL NEURAL NETWORKS



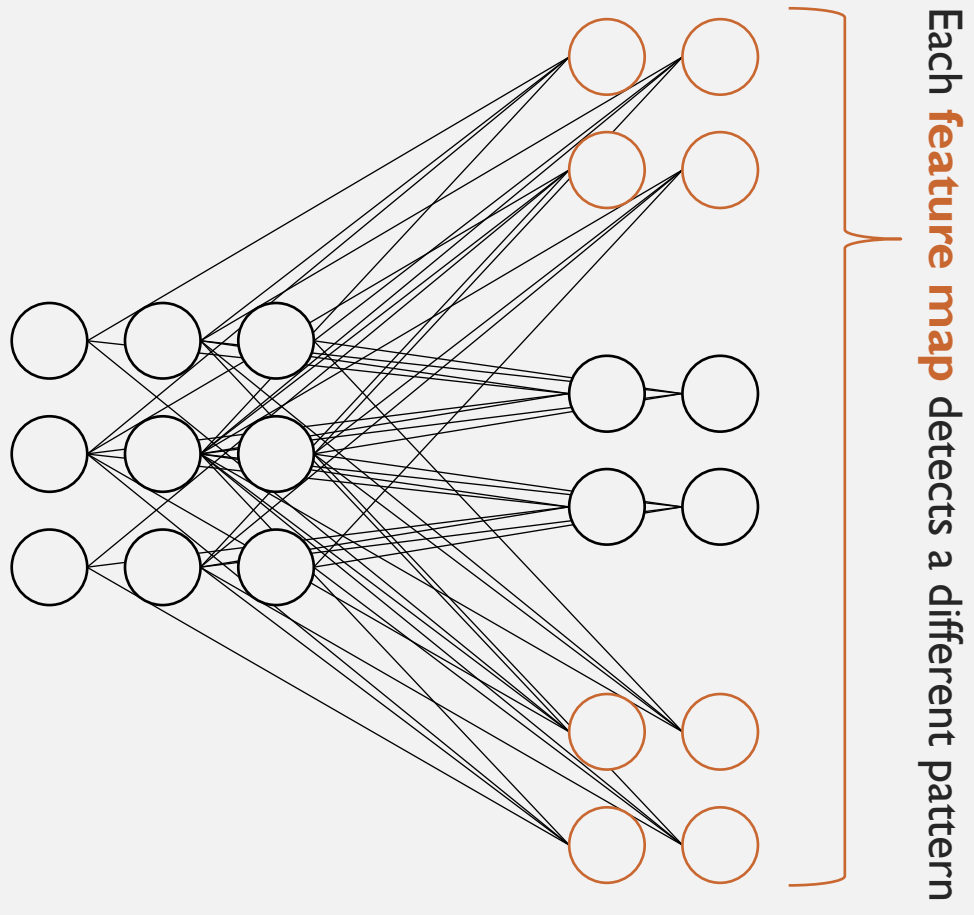
# CONVOLUTIONAL NEURAL NETWORKS



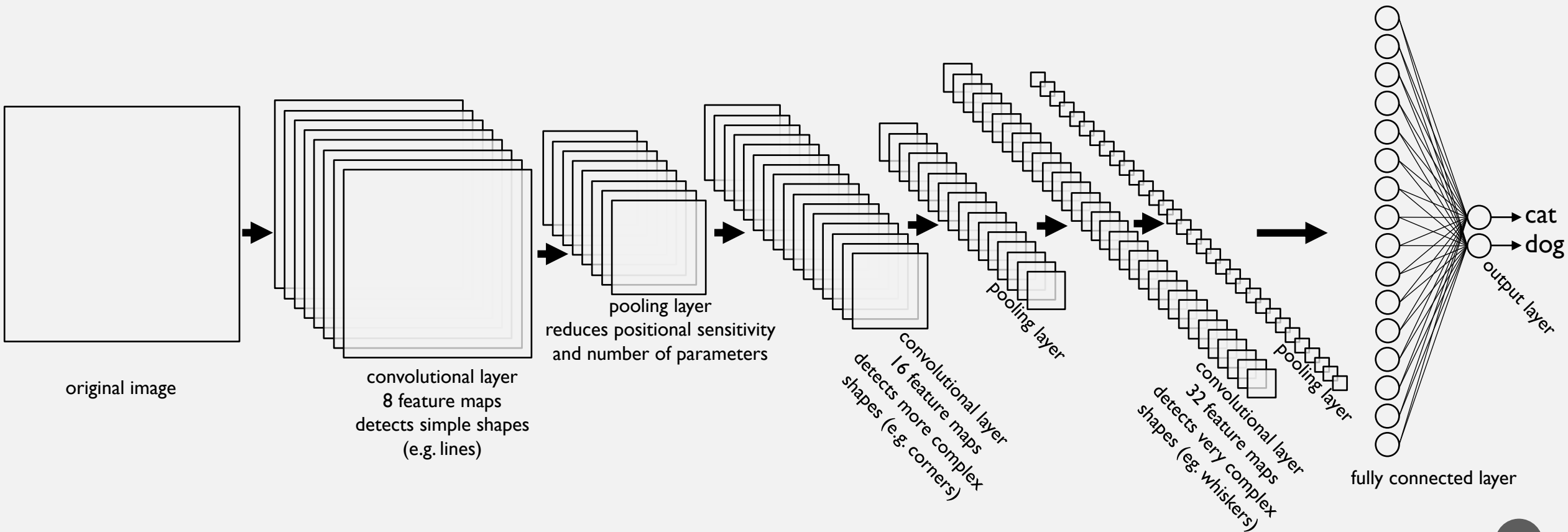
Each neuron in the hidden layer detects the same pattern, but at different positions in the image.



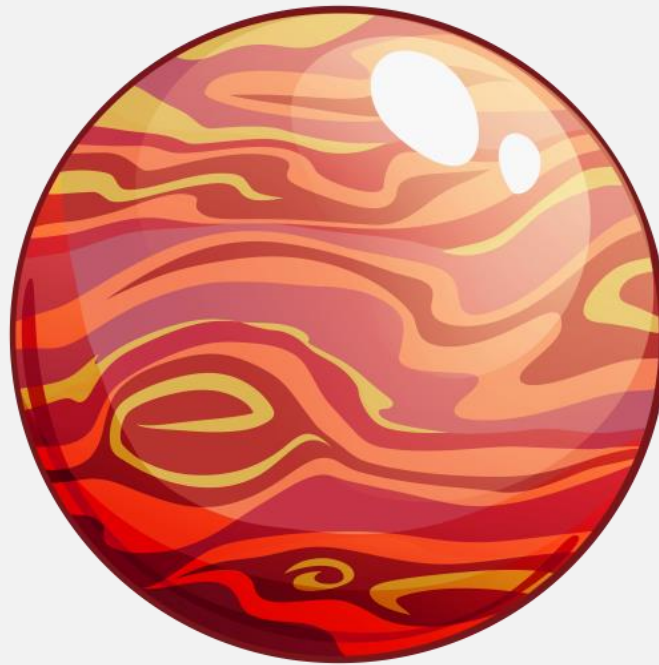
# CONVOLUTIONAL NEURAL NETWORKS



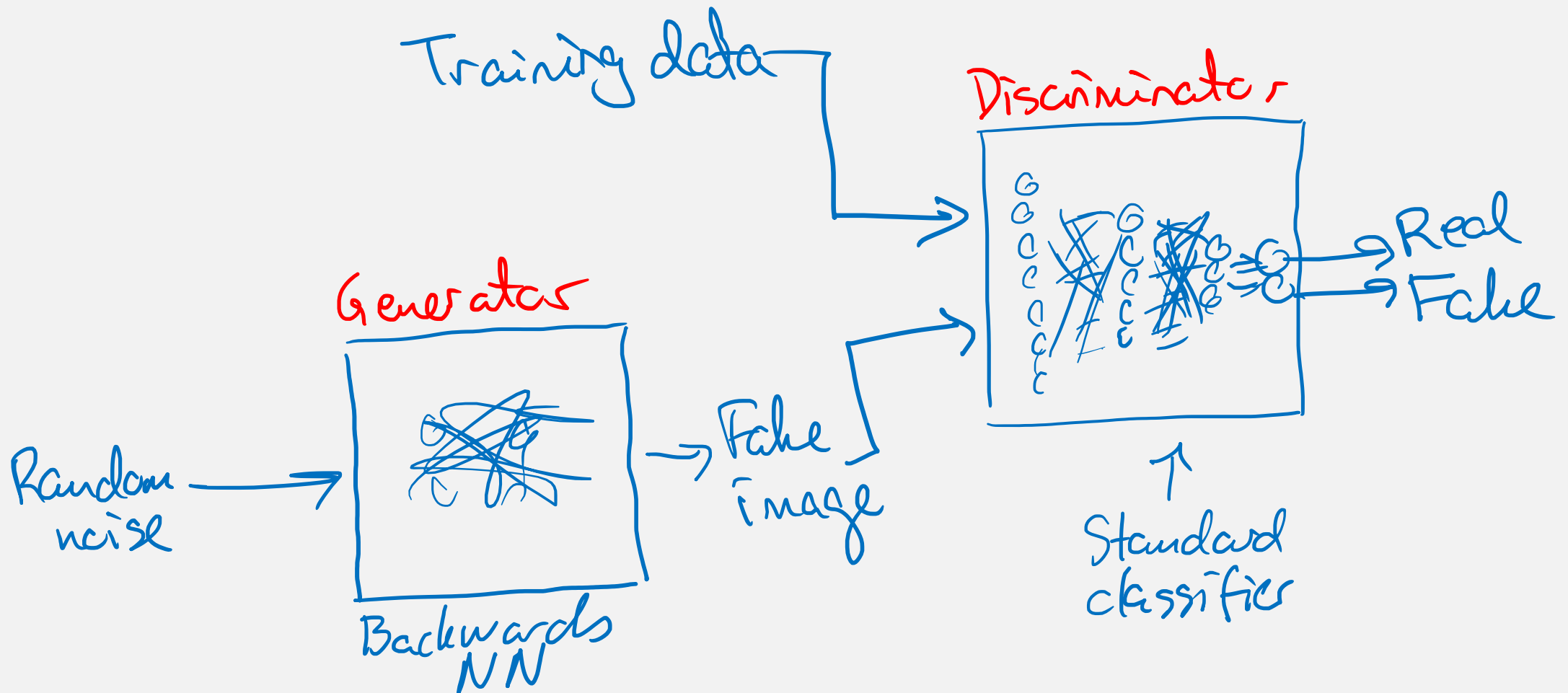
# CONVOLUTIONAL NEURAL NETWORKS



# CONVOLUTIONAL NEURAL NETWORKS



# GENERATIVE ADVERSARIAL NETWORKS



# GENERATIVE ADVERSARIAL NETWORKS

- The **discriminator** becomes better and better at classifying real vs. fake
- The **generator** becomes better and better at generating images that look real

# GENERATIVE ADVERSARIAL NETWORKS





# GENERATIVE ADVERSARIAL NETWORKS



# RECURRENT NEURAL NETWORKS

She saw a bat



Hun så en flagermus

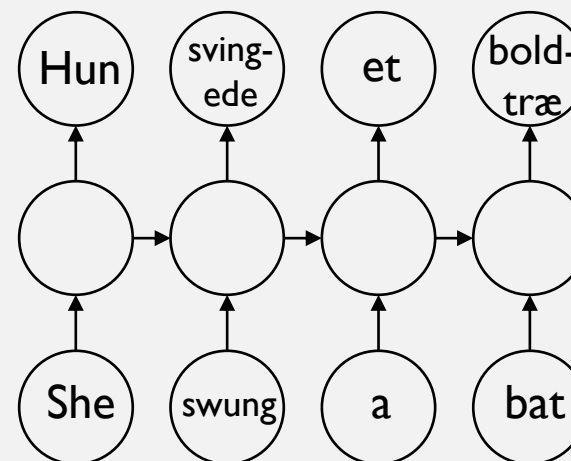
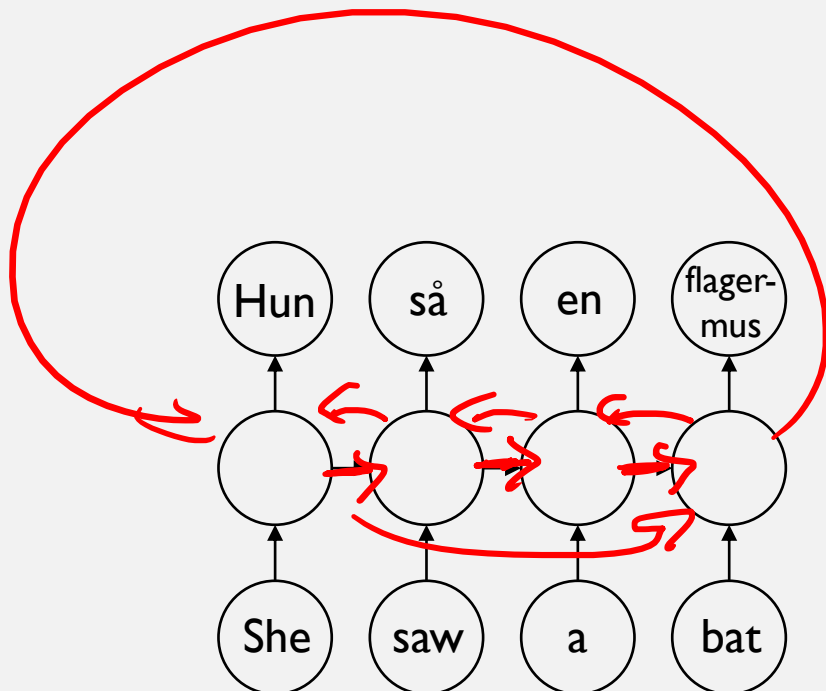
She swung a bat



Hun svingede et boldtræ



# RECURRENT NEURAL NETWORKS



# RECURRENT NEURAL NETWORKS



[translate.google.com](https://translate.google.com)

# RECURRENT NEURAL NETWORKS

The screenshot displays a language learning application interface with two panels. Each panel has a header with language selection options: 'Registrer sprog', 'Dansk', 'Engelsk', and 'Tysk' (top panel) or 'Engelsk', 'Dansk', and 'Estisk' (bottom panel). The top panel shows the 'Engelsk' tab selected, with a list of English sentences: 'he is a nurse', 'she is a doctor', 'he is beautiful', and 'she is strong'. Below these are icons for voice input and output, and a progress indicator '59 / 5.000'. The bottom panel shows the 'Estisk' tab selected, with a list of Estisk sentences: 'ta on õde', 'ta on arst', 'ta on ilus', and 'ta on tugev'. Below these are similar icons and a progress indicator '43 / 5.000'. Both panels have a right sidebar with a star icon and icons for copy, share, and feedback.

Registrer sprog Dansk **Engelsk** Tysk

he is a nurse  
she is a doctor  
he is beautiful  
she is strong

59 / 5.000

↔ **Estisk** Dansk Engelsk

ta on õde  
ta on arst  
ta on ilus  
ta on tugev

43 / 5.000

Registrer sprog **Estisk** Engelsk Dansk

ta on õde  
ta on arst  
ta on ilus  
ta on tugev

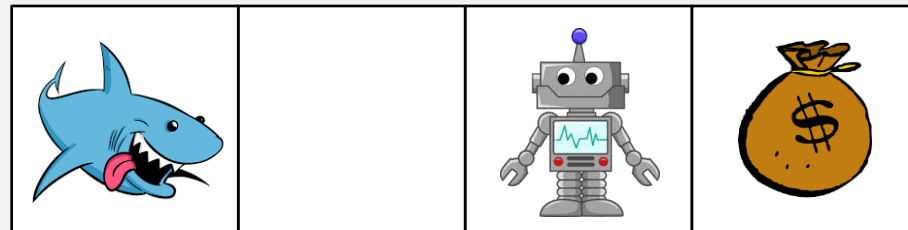
43 / 5.000

↔ Estisk Dansk **Engelsk**

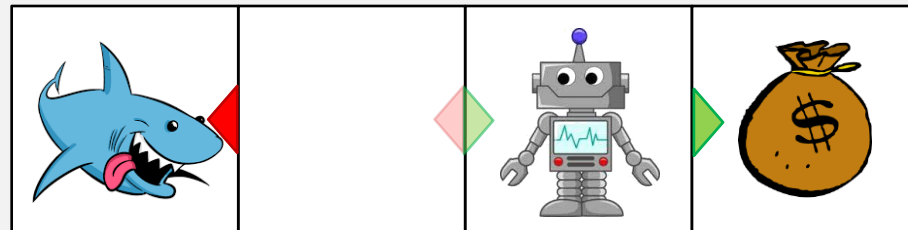
she is a nurse  
he is a doctor  
she is beautiful  
he is strong

the model is only as good as the data it's trained on

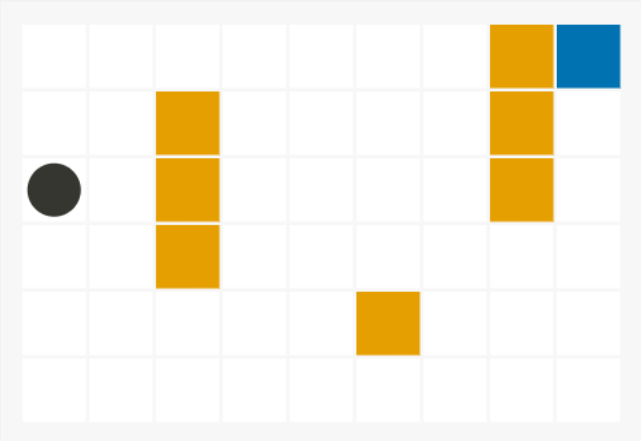
# REINFORCEMENT LEARNING



# REINFORCEMENT LEARNING



# REINFORCEMENT LEARNING



# REINFORCEMENT LEARNING

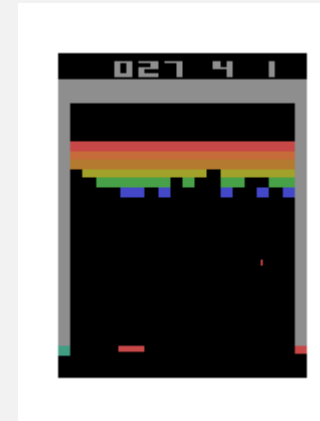
Before training



Early training



Late training



# REINFORCEMENT LEARNING



Silver, D., Huang, A., Maddison, C. *et al.* Mastering the game of Go with deep neural networks and tree search. *Nature* **529**, 484–489 (2016)



# AI ETHICS

It's all fun and games ...

... until our judicial system can no longer trust images and videos

... until chatbots start instructing children how to hurt themselves

... until self-driving cars kill pedestrians and no one can say who's responsible

... until you end up starring in deepfake pornography

# AI ETHICS

## 1. Proportionality and Do No Harm

The use of AI systems must not go beyond what is necessary to achieve a legitimate aim. Risk assessment should be used to prevent harms which may result from such uses.

## 2. Safety and Security

Unwanted harms (safety risks) as well as vulnerabilities to attack (security risks) should be avoided and addressed by AI actors.

## 3. Right to Privacy and Data Protection

Privacy must be protected and promoted throughout the AI lifecycle. Adequate data protection frameworks should also be established.

## 4. Multi-stakeholder and Adaptive Governance & Collaboration

International law & national sovereignty must be respected in the use of data. Additionally, participation of diverse stakeholders is necessary for inclusive approaches to AI governance.

## 5. Responsibility and Accountability

AI systems should be auditable and traceable. There should be oversight, impact assessment, audit and due diligence mechanisms in place to avoid conflicts with human rights norms and threats to environmental wellbeing.

## 6. Transparency and Explainability

The ethical deployment of AI systems depends on their transparency & explainability (T&E). The level of T&E should be appropriate to the context, as there may be tensions between T&E and other principles such as privacy, safety and security.

## 7. Human Oversight and Determination

Member States should ensure that AI systems do not displace ultimate human responsibility and accountability.

## 8. Sustainability

AI technologies should be assessed against their impacts on 'sustainability', understood as a set of constantly evolving goals including those set out in the UN's Sustainable Development Goals.

## 9. Awareness & Literacy

Public understanding of AI and data should be promoted through open & accessible education, civic engagement, digital skills & AI ethics training, media & information literacy.

## 10. Fairness and Non-Discrimination

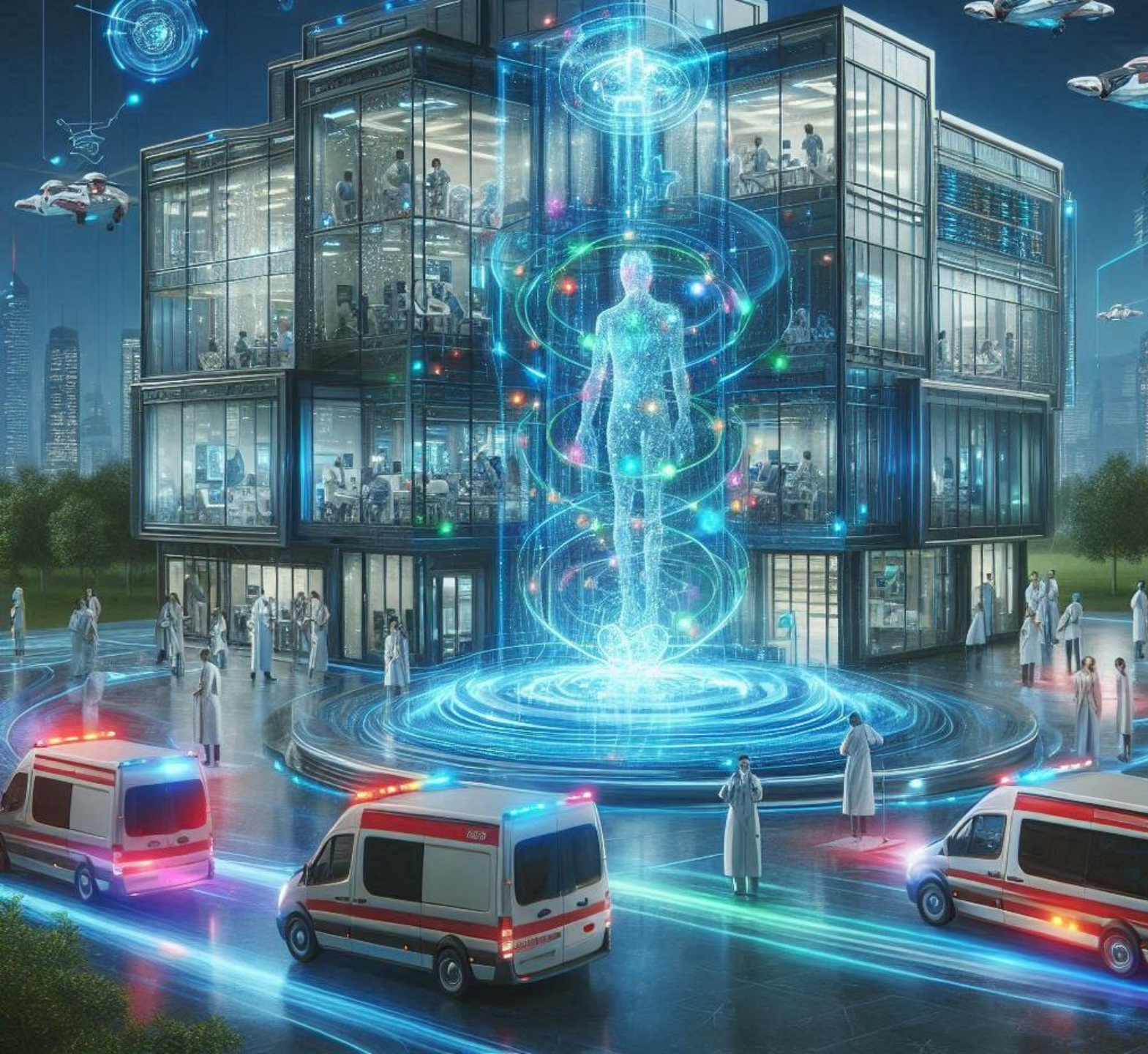
AI actors should promote social justice, fairness, and non-discrimination while taking an inclusive approach to ensure AI's benefits are accessible to all.



**You**

what do you think ai can do in 10 years





# ADVANCED HEALTHCARE

AI WILL PLAY A  
SIGNIFICANT ROLE IN  
PERSONALIZED MEDICINE,  
DISEASE DIAGNOSIS, DRUG  
DISCOVERY, AND  
TREATMENT OPTIMIZATION





# AUTONOMOUS VEHICLES

SELF-DRIVING CARS AND  
DRONES MAY BECOME  
MORE COMMONPLACE,  
REVOLUTIONIZING  
TRANSPORTATION AND  
LOGISTICS





# NATURAL LANGUAGE PROCESSING

AI WILL CONTINUE TO  
IMPROVE IN  
UNDERSTANDING AND  
GENERATING HUMAN-LIKE  
TEXT, ENABLING MORE  
NATURAL INTERACTIONS  
WITH MACHINES





# CLIMATE CHANGE SOLUTIONS

AI CAN AID IN CLIMATE  
MODELING, RESOURCE  
MANAGEMENT, AND THE  
DEVELOPMENT OF  
SUSTAINABLE  
TECHNOLOGIES TO  
COMBAT CLIMATE CHANGE





# EDUCATION

AI-DRIVEN PERSONALIZED  
LEARNING PLATFORMS  
WILL ADAPT TO  
INDIVIDUAL STUDENT  
NEEDS, ENHANCING  
EDUCATIONAL OUTCOMES





# CYBERSECURITY

AI WILL BE CRUCIAL IN  
DEFENDING AGAINST  
CYBER THREATS,  
IDENTIFYING  
VULNERABILITIES, AND  
RESPONDING TO ATTACKS  
IN REAL-TIME





# VIRTUAL ASSISTANTS

VIRTUAL ASSISTANTS WILL  
BECOME EVEN MORE  
INTEGRATED INTO DAILY  
LIFE, ASSISTING WITH  
TASKS, SCHEDULING, AND  
INFORMATION RETRIEVAL

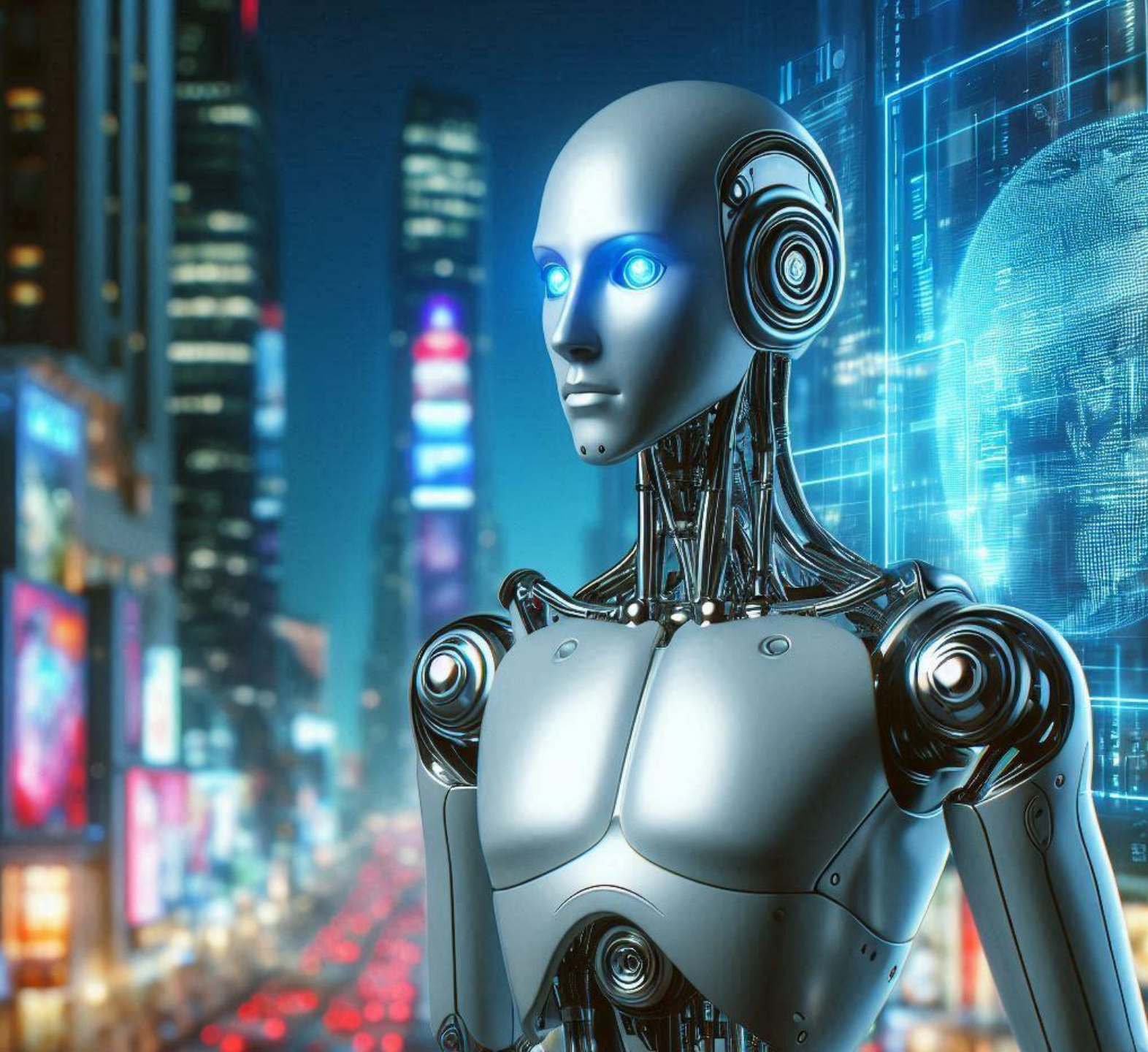




# CREATIVE INDUSTRIES

AI WILL CONTRIBUTE TO  
ART, MUSIC, AND  
LITERATURE CREATION,  
COLLABORATING WITH  
HUMAN CREATORS TO  
PRODUCE INNOVATIVE  
WORKS





# ROBOTICS

ADVANCES IN AI WILL  
LEAD TO MORE  
SOPHISTICATED ROBOTS  
CAPABLE OF COMPLEX  
TASKS IN  
MANUFACTURING,  
HEALTHCARE, AND  
DOMESTIC SETTINGS





## ETHICAL CONSIDERATIONS

THERE WILL BE INCREASED  
FOCUS ON ADDRESSING THE  
ETHICAL IMPLICATIONS OF  
AI, INCLUDING BIAS  
MITIGATION, TRANSPARENCY,  
AND ACCOUNTABILITY IN AI  
SYSTEMS

Only time will tell what's going to happen ...



