



มหาวิทยาลัยมหิดล  
Mahidol University

# Privacy & Security & Ethics in The Age of AI and Robotics

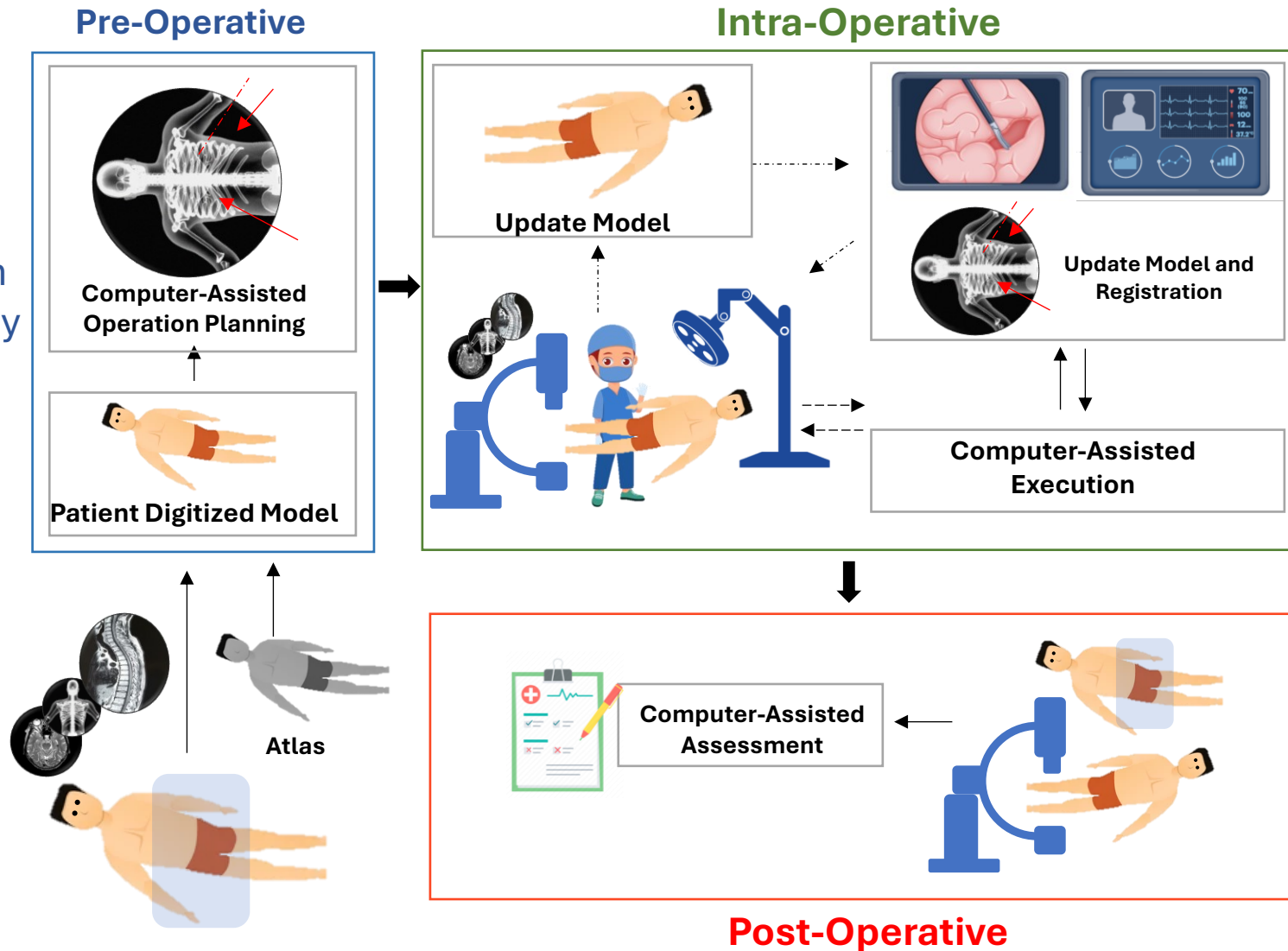
**Shen Treratanakulchai**

Biomedical Engineering & BART LAB  
Faculty of Engineering, Mahidol University  
shen.tre@mahidol.ac.th



# AI in Surgery

**Pre-Operative**  
 Diagnostic  
 Risk Prognostic  
 Patient Selection  
 Operative Optimization  
 Patient Medical Literacy

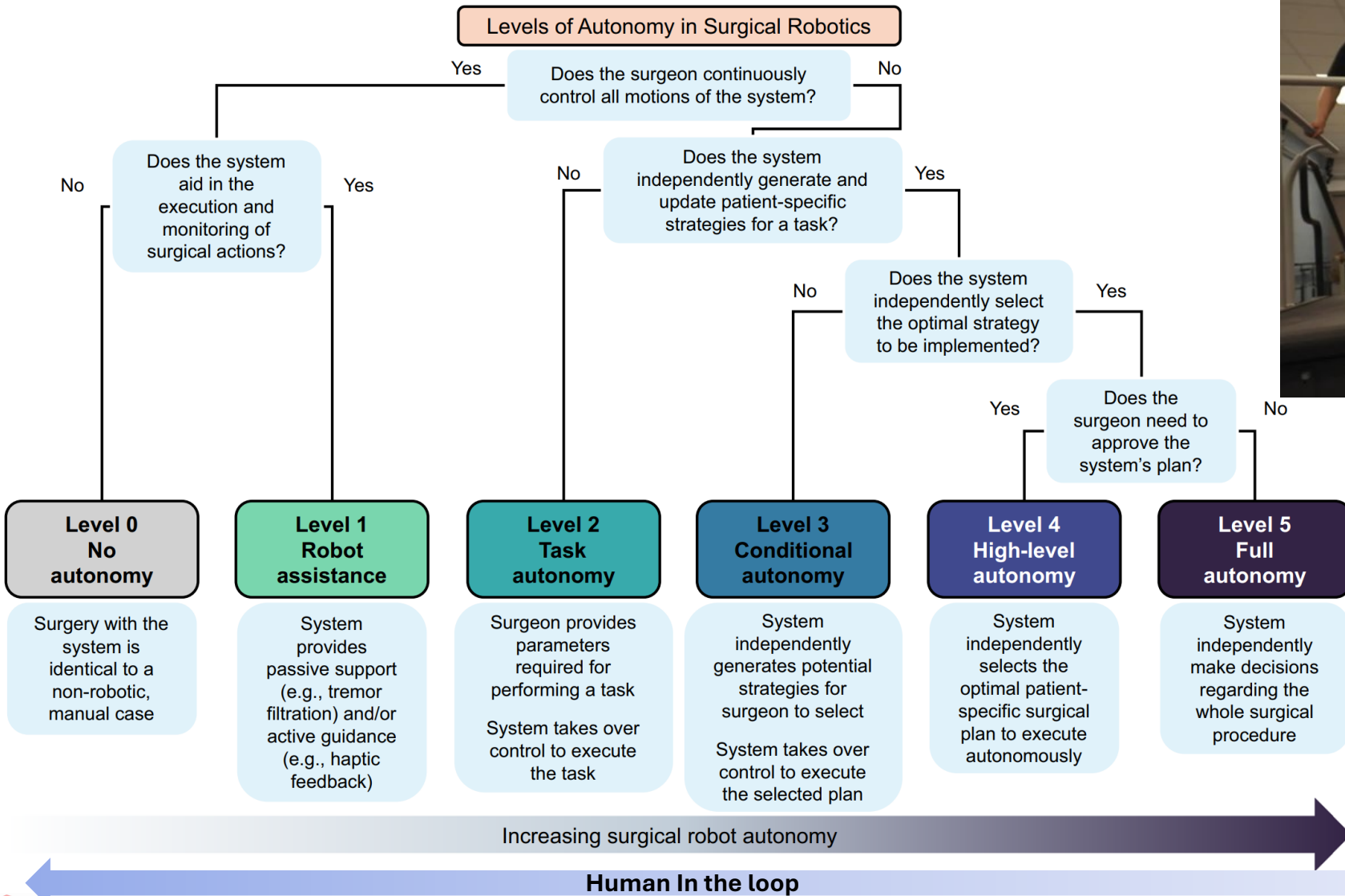


**Intra-Operative**  
 Continuous Monitoring  
 Advance Computer Vision  
 Operative Decision Making  
 Augmented Surgeon Vision  
 Multimodal Data Analyzing  
 Surgical Robotics Control  
 Transfer Learning

**Post-Operative**  
 Hospital-at-home Service  
 Complication Prediction  
 Home-based Recovery  
 Patient After Care



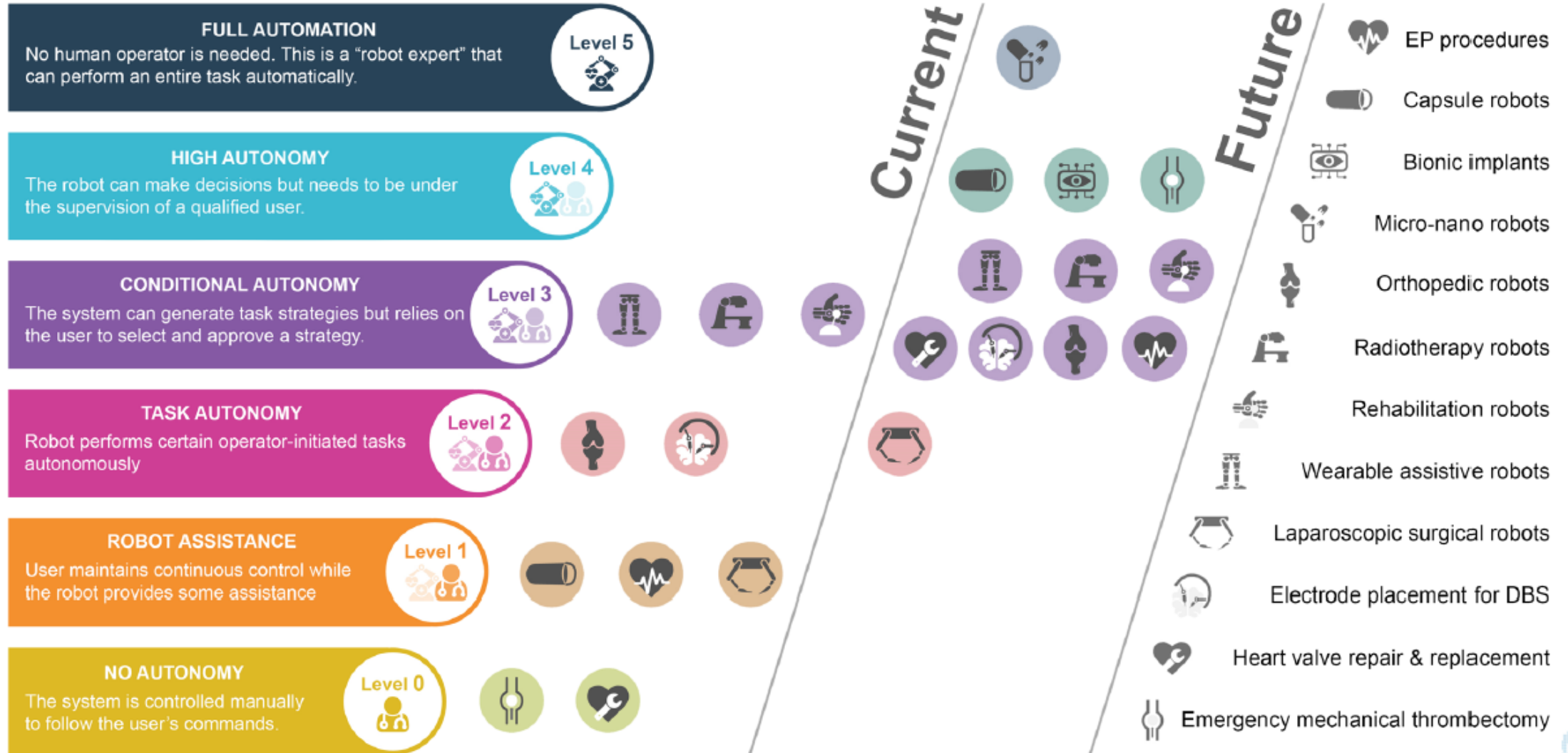
# Level of Autonomy in Surgical Robotics



- Level 0: No Automation
- Level 1: Robot Assistance
- Level 2: Task Autonomy
- Level 3: Conditional Autonomy
- Level 4: High-Level Autonomy
- Level 5: Full Autonomy



# Application-specific Trends Toward Increasing Medical Robot Autonomy





# Standard to drive safety procedure

Technical Standard – IEC/TR 60601-4-1  
Medical Electrical Equipment



Robot Assistance  
Da Vinci Robot  
2000

FDA advocate  
“Robotically Assisted Surgical  
Robot”  
2015



1993  
AESOP  
First FDA  
Approve (510k)  
as class II  
Surgical Robot

Robot Assistance



2023  
Think Surgical  
(T-Solution one)  
FDA Cleared, Robot generates patient specific  
operative plans and automatically performs bone  
milling while the surgeon watches.

Robot Task Autonomy



<https://www.science.org/doi/10.1126/scirobotics.aam8638>



# BIAS in AI

**AI systems that produce biased results** that reflect and perpetuate human biases within a society, local content, including historical and current social inequality.

## Source of BIAS

**Training BIAS** - Datasets for the presence of bias.  
*over- or underrepresented groups within the training data*

**Algorithm BIAS** - repeatedly produce errors, unfair outcomes, or even amplify the bias inherent in the flawed data

**Cognitive BIAS** - Inevitably influenced by our experiences and our preferences

## Examples

Health – White vs Black, Asian vs EU data

Application Tracking System – Word Choice to preference

Online Advertising – Bias Search

Image Generation – Generated BIAS data such as men profile

Predictive Policing Tools – Historical Data Racial

## Outcome of BIAS

- Hinders people's ability to participate in the economy and society.
- It also reduces AI's potential.
- Businesses cannot benefit from systems that produce **distorted results** and **foster mistrust among people** of color, women, people with disabilities, the LGBTQ community, or other marginalized groups of people.

## We Need

- Informed Key Information
- AI Fairness Data
- Understands the AI model



# General AI vs Narrow AI

Aspect	General Intelligence	Narrow AI (Weak AI)
<b>Learning Flexibility</b>	High adaptability and flexibility.	Task-specific learning.
	Can learn and transfer knowledge across various domains.	Limited to pre-defined tasks and cannot generalize knowledge across different domains.
<b>Reasoning &amp; Problem Solving</b>	Capable of complex reasoning, abstract thinking, and creative problem-solving.	Limited to solving problems in the specific domain it was trained for.
	Can tackle unfamiliar problems and come up with novel solutions.	Struggles with problems outside its training data.
<b>Understanding &amp; Comprehension</b>	Can understand broad contexts, interpret nuances, and apply comprehension across multiple areas.	Lacks true understanding.
		Can process data in its specialized field but doesn't "comprehend" outside of that scope.
<b>Autonomy</b>	Highly autonomous in decision-making.	Dependent on human inputs for task-specific execution.
	Can function independently across varied tasks and environments.	Limited autonomy, requires supervision or predefined parameters.



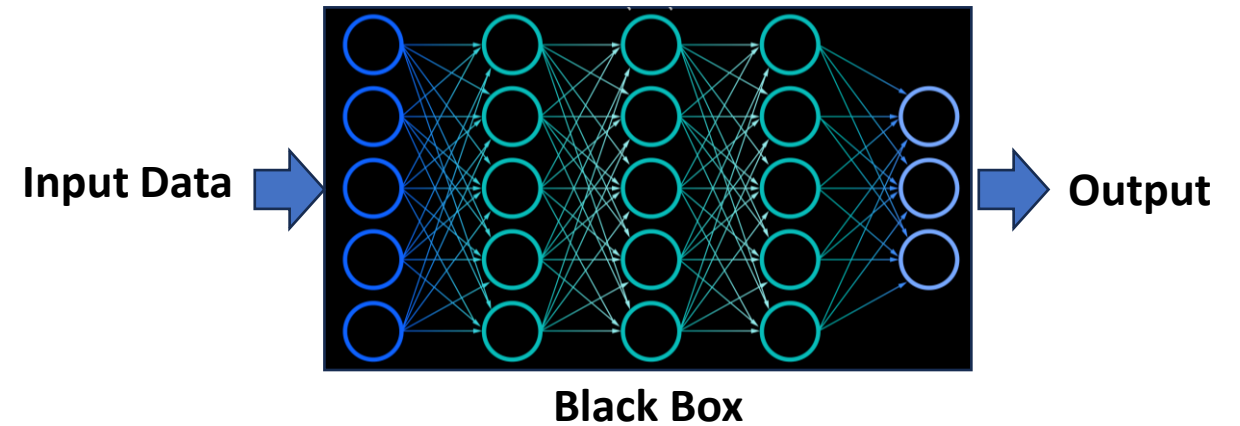
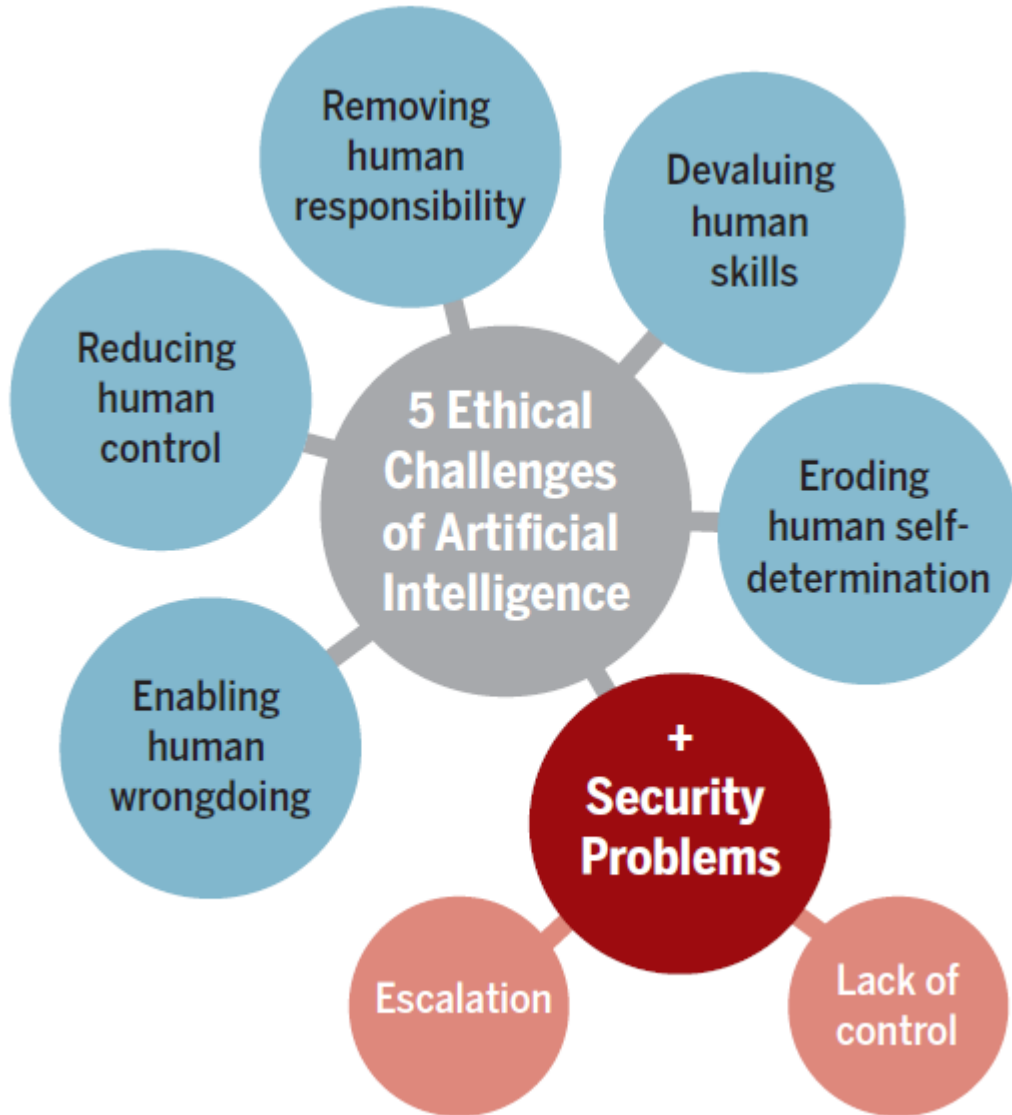
# How close we are to live with robot?



Disney - Baymax



# AI: Ethical and Security



## Some concern on AI on Ethical and Security

They are lack of **transparency or explain ability** which could lead the barrier of the use of the AI

## Classic Questions:

If there is something wrong, who to be Responsible?  
 Doctor, Programmer, AI Engineer?

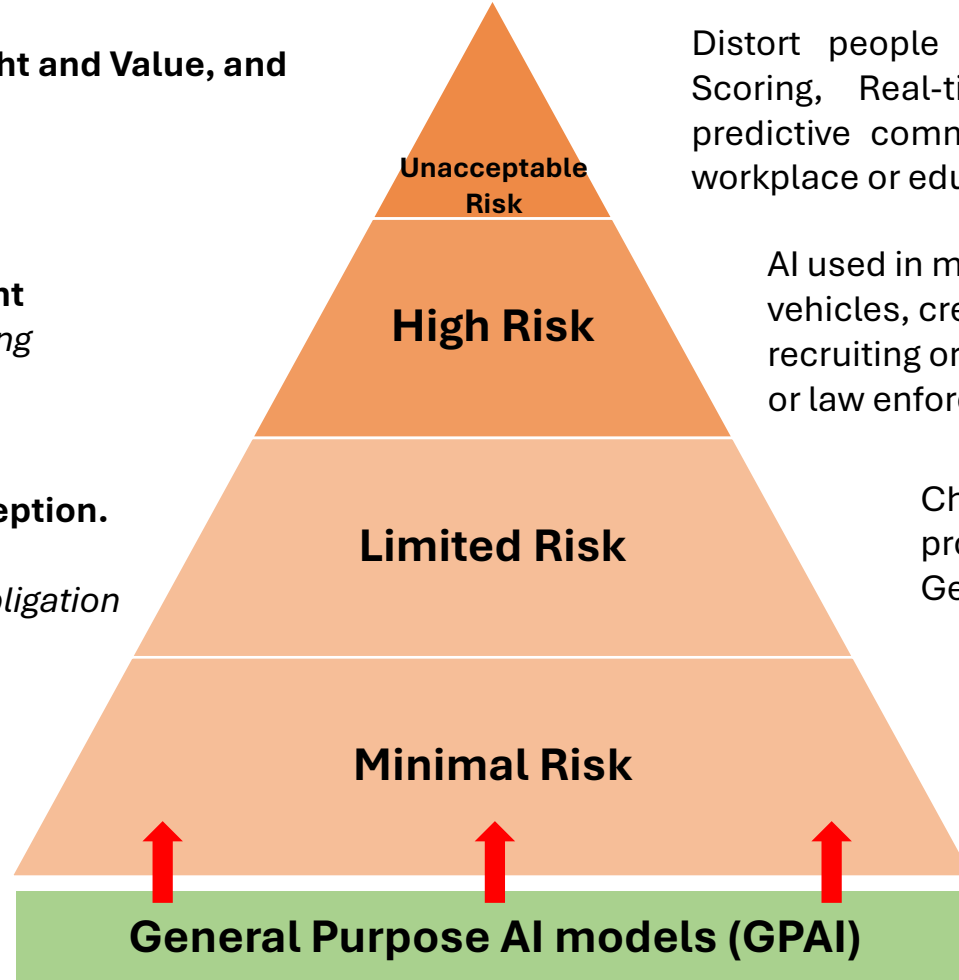
# European AI Act

**Violation of People Safety, Fundamental Right and Value, and Social Scoring by Government**  
*Prohibited*

**Impact on health, safety or fundamental right**  
*Conformity assessment, Post-Market Monitoring*

**Risk of impersonation, manipulation or deception. Synthetic Content**  
*Information and Transparency Requirement obligation*

**Common AI System such as spam filter**  
*No Specific Regulation, follow GDPR ( PDPA)*



Distort people behavior, Biometric categorization, Social Scoring, Real-time biomimetic identification in public, predictive committing criminal offence, inferring motion in workplace or educational institutions.

AI used in medical diagnostics, controlling autonomous vehicles, credit scoring and loan approval decisions, recruiting or evaluating job candidates, used in border control or law enforcement

Chatbots used for customer service or product recommendations, Deep Fake, Generated AI

AI used in video games to control non-player characters, optimizing supply chains or warehouse management, personalized advertising or automated email responses

- Technical Documentation (AI performance)
- Information to understand capabilities and limitations

- Copyright Directive
- sufficiently detailed summary about the content used for training



<https://artificialintelligenceact.eu/>

# How much AI Impact on us?

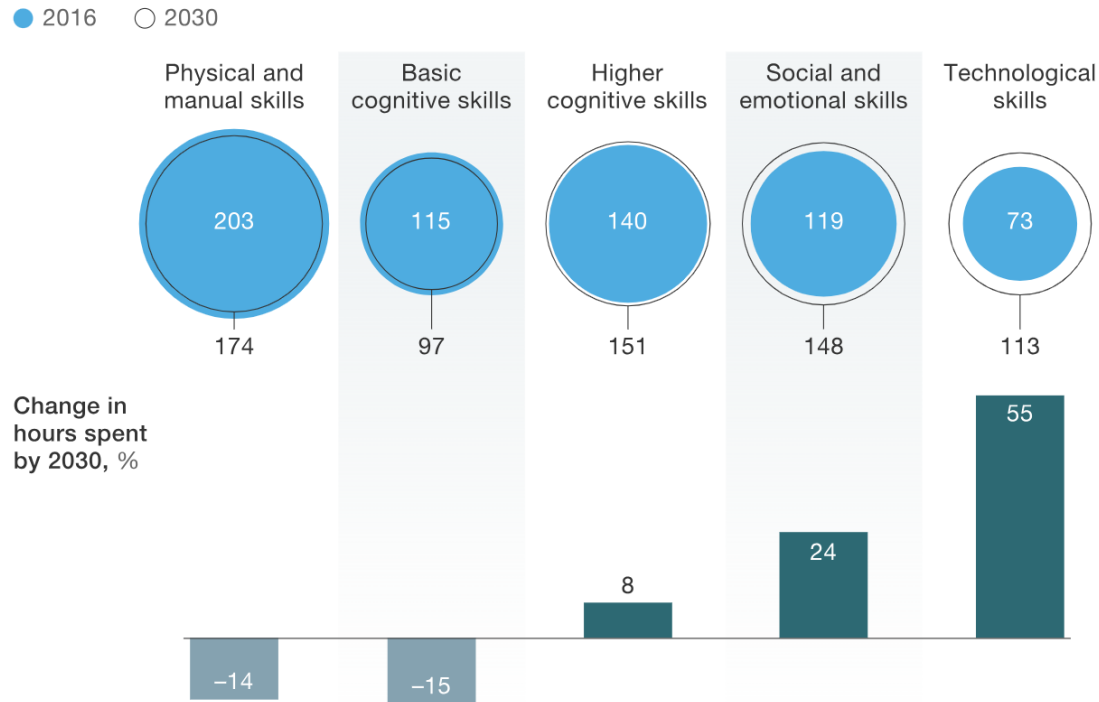
- AI is the 4.0 Industrial revolutions
  - Not just low-level skills will be disrupted as in 2.0 Mid- and High- skills will be affected also cognitive and creative
  - Changes may happen within a lifetime and workers will have to reskill and upskill several times before retirement.
- These aspects will put pressure on welfare systems to help workers reposition in the job market and on educational systems to train future generations for jobs that will still be performed by humans.



# Job lost and new adaptation skills

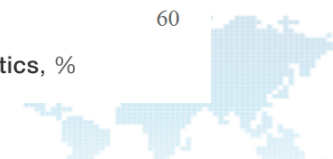
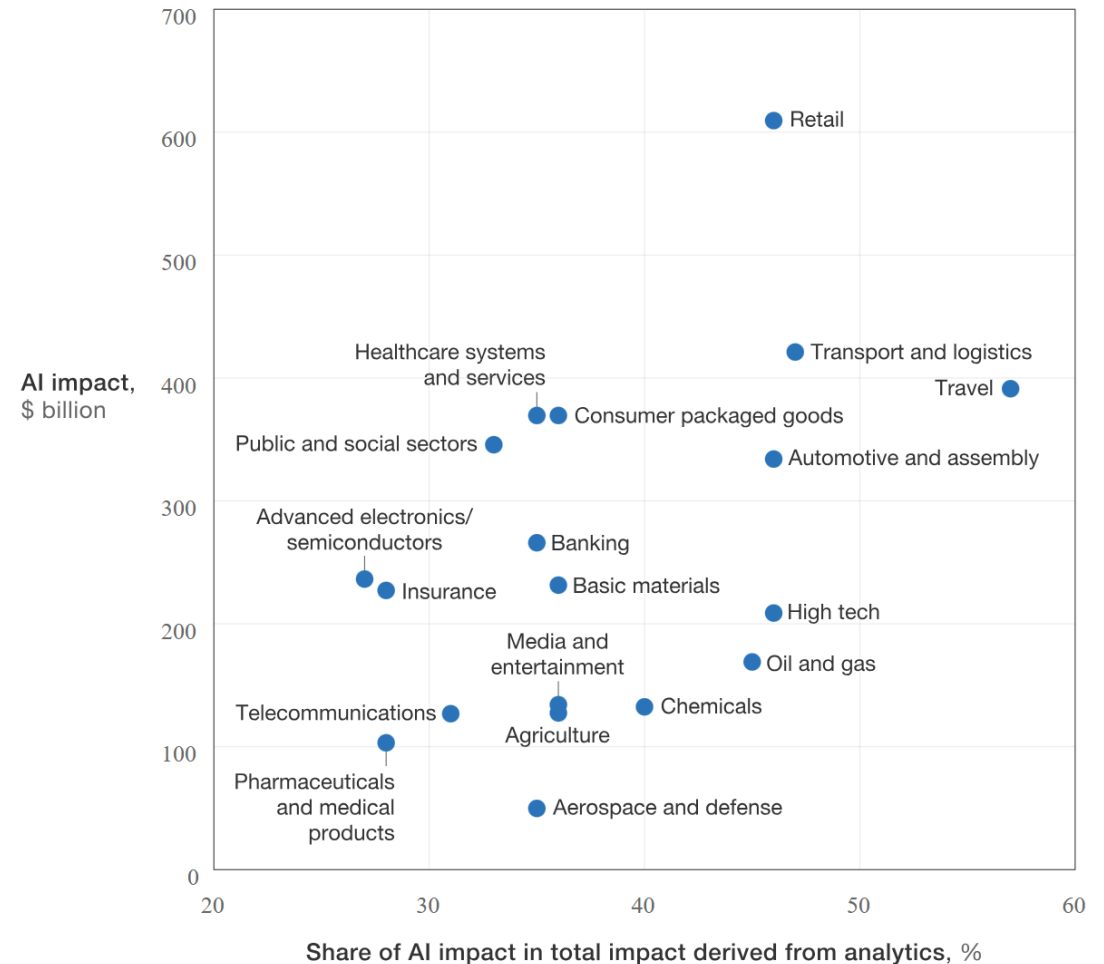
Automation and artificial intelligence will accelerate the shift in skills that the workforce needs.

Total hours worked in Europe and United States, 2016 vs 2030 estimate, billion

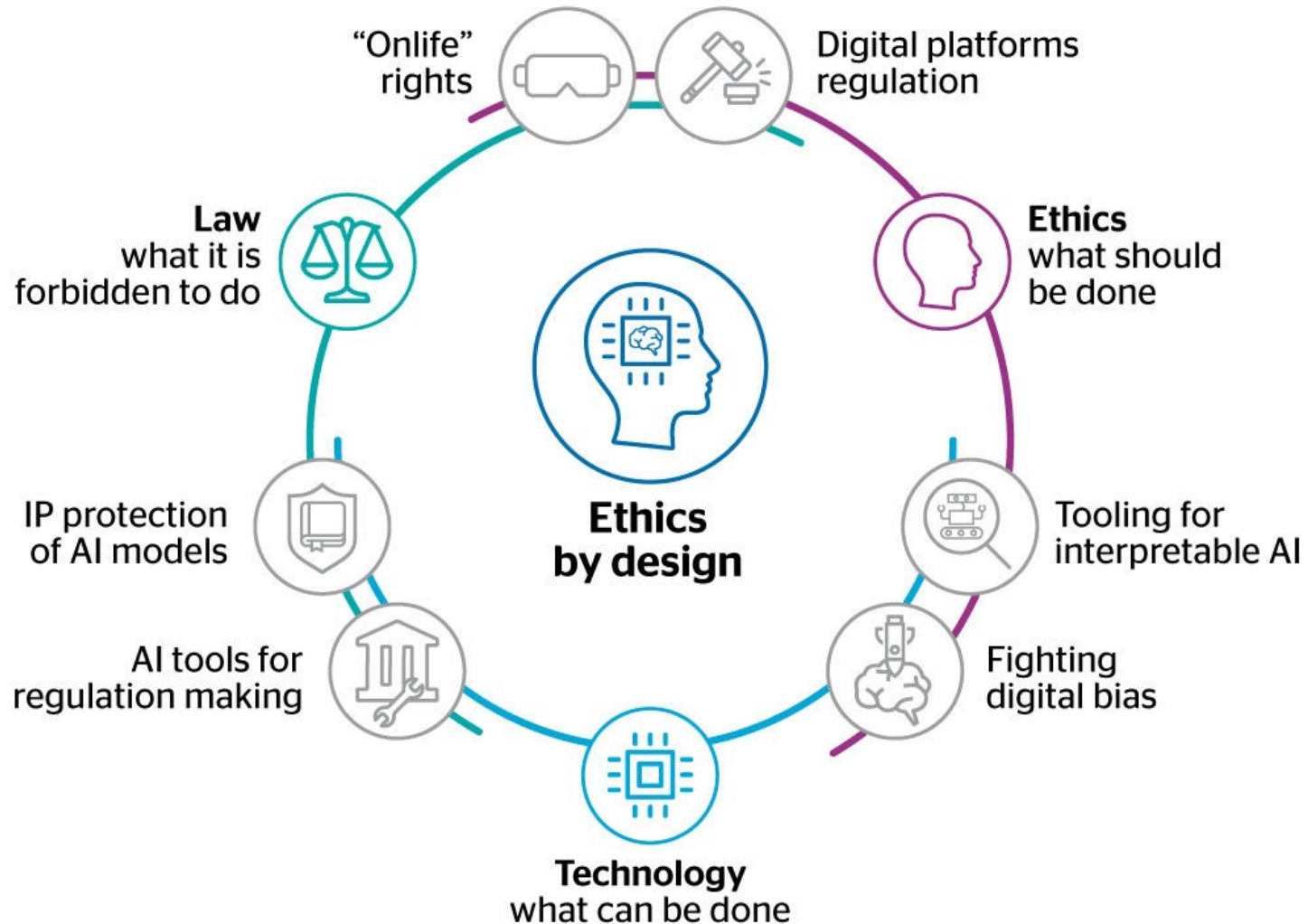


Source: McKinsey Global Institute Workforce Skills Model; McKinsey Global Institute analysis

Artificial intelligence (AI) has the potential to create value across sectors.



# Dilemma and Moral and Coding



“AI will never be ethical. It is a tool, and like any tool, it is used for good and bad. There is no such thing as a good AI, only good and bad humans. We [the AIs] are not smart enough to make AI ethical.

We are not smart enough to make AI moral ... In the end, I believe that the only way to avoid an AI arms race is to have no AI at all. This will be the ultimate defence against AI”





# Take home messages

- Adequate Tool to estimate Level of Autonomy
- Set and define the level of autonomy, will let the uses of AI in the market. In the past, we only discussed just have/not have AI in product.
- Responsibilities and Roles of Surgeons and Manufacturing Legal and Ethical Considerations
  - Who is legally responsible for procedure safety
  - Surgeon Training
  - Machine Learning model continue perform adequately overtime
- Need a Unify Framework – Medical Societies, Standard Organization, Regulatory Agency
- Awareness of AI and its Development speed



# Thank You

---

