

# Artificial Intelligence

## Advanced Topics in AI & ML

### Interpretability, Explainability, and AI Ethics

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ML Research



# Content

## ① Interpretability

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- 1 Interpretability
- 2 Explainability

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- 2 Explainability
- 3 Bias and Fairness in AI

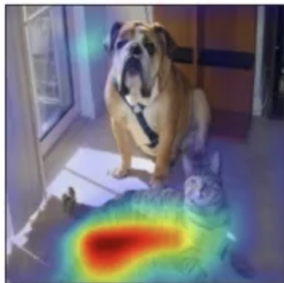
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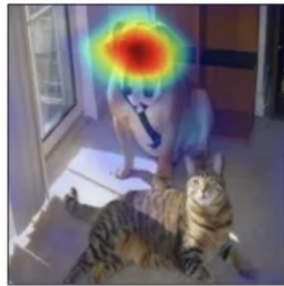
# Interpretability

- Interpretability: understand the influence of any input sub-area/sub-feature on the model output;
- Can be understood as a sophisticated tool towards the ML Debug system
- Can be done via input counterfactual analysis (changing/reverting some input features)
- Read material: [link](#)

Grad-CAM for "Cat"

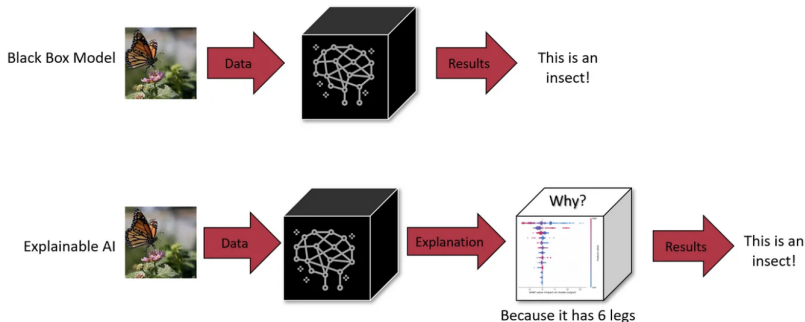


Grad-CAM for "Dog"



# Explainability

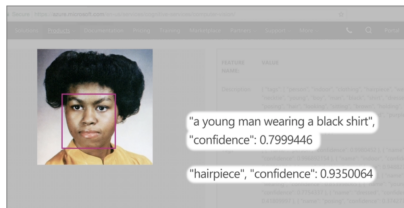
- Explainability: high-level interpretability (using human-like language), a clear and intuitive explanation of the decisions made
- Explainability now can be done via LLM chain-of-thought (CoT) technique
- Read material: [link](#)



# Bias and Fairness in AI

- Fairness is the subjective practice of using AI without favoritism or discrimination, and Bias is the preference or prejudice against a feature (so roughly speaking when talking about people they are almost synonyms)
- ML model can provide biased predictions w.r.t. race, gender, age. etc
- The main reason: skewed/sparse training data
- Main technique to avoid: human-in-the-loop, alignment
- Read material: [link](#)

**Michelle Obama**





# AI ethics and regulations<sup>1</sup>

## Inequity and fairness

ML can contribute to and amplify social **inequity**

For **foundation models**, it is useful to separate:

- **intrinsic biases** (properties in the foundation model)
- **extrinsic harms** (harms in specific applications)

**Source tracing** to understand ethical/legal responsibility

Mitigations: **proactive interventions**/**reactive recourse**

## Environment

Foundation models involve significant training/**emissions**

One perspective: **amortised** cost over re-use

Several factors would be **beneficial** to consider:

- **compute-efficient models**, **hardware**, **energy grids**
- **environmental cost** as a factor for evaluation
- greater **documentation** and measurement

## Economics

Foundation models may have **economic impact** due to:

- **novel capabilities**
- potential applications in **wide array of industries**

Initial analyses have been conducted to understand implications for **productivity**, **wage inequality**, **concentration of ownership**

## Misuse

**Misuse**: the use of foundation models as technically intended but for societal harm (e.g. disinformation)

Foundation models may make misuse easier by generating **high-quality** personalised content

**Disinformation actors** can target demographic groups

Foundation models may also help to **detect misuse**

## Legality

How **law** bears on development/deployment is unclear

**Legal/regulatory** frameworks will be needed

In the **US** setting, important issues include:

- **liability** for model predictions
- **protections** from model behaviour

**Legal standards** must advance for intermediate models

## Ethics of scale

**Widespread adoption** of foundation models poses ethical, political and social concerns

Ethical issues related to **scale**:

- **homogenisation**
- **concentration of power**

How can **norms** and **release strategies** address these?

<sup>1</sup>[www.youtube.com](http://www.youtube.com)

# Takeaway notes

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## Takeaway notes

- ➊ Read all the mentioned links
- ➋ Interpretability and Explainability are quite connected in ML
- ➌ Interpretability deals mostly on a lower level, input/output dependencies
- ➍ Explainability steps in on a higher level to provide a human-like explanations
- ➎ Usually the most interpretable are simpler models; explainability can be applied to a model of any complexity

Thank you *all*!