Responsible and Sustainable AI for Embedded Systems

Romina Soledad Molina, Ph.D.
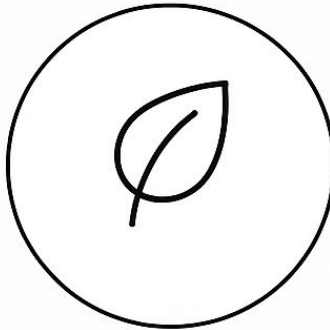MLab-STI, ICTP

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Responsible and Sustainable AI for Embedded Systems

Ethics   Privacy   Sustainability   Responsibility

Responsible and Sustainable AI for Embedded Systems

Ethics, Privacy, Sustainability, and Responsibility

- **Ethics**
Ensure fairness, transparency, and accountability in AI models.
Avoid bias propagation and promote explainable ML — even on constrained hardware.

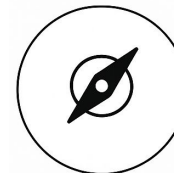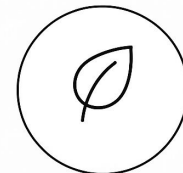Ethics   Privacy   Sustainability   Responsibility

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  Adopt privacy-preserving techniques such as federated learning or encryption.

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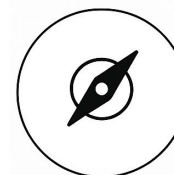**Ethics, Privacy, Sustainability, and Responsibility**

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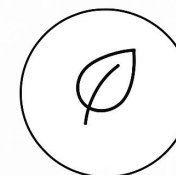 Protect sensitive data processed locally on embedded devices.
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- **Sustainability**
  Optimize energy consumption and computational efficiency.
  Design lightweight models that minimize environmental impact.

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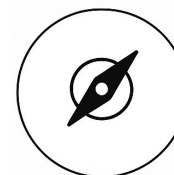
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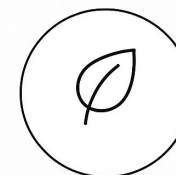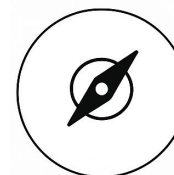 Optimize energy consumption and computational efficiency.
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- **Responsibility**
  Promote safe and reliable AI deployment.
  Encourage human oversight and continuous evaluation of system behavior.

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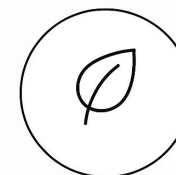
Responsible and Sustainable AI for Embedded Systems

- **Fairness:**
  - Ensure models serve all users equitably.

- **Bias:**
  - Prevent bias propagation during optimization or quantization.

- **Transparency:**
  - Promote explainable and auditable ML, even on hardware.

- **Accountability:** Maintain traceability from data to deployment.

Responsible and Sustainable AI for Embedded Systems

Privacy

- **On-device ML with FPGAs:**
  - Less data sent to the cloud.

- **Data sovereignty:**
  - allowing users or organizations to maintain control over their information.

- **Local inference:**
  - Enables real-time anonymization and secure data processing at the edge.

- **Challenge:**
  - Balance between performance and confidentiality.

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- **FPGAs**
  - Lower energy use than GPUs.

- **Reconfigurable:**
  - Longer hardware lifespan.

- **Efficiency** reduces AI's carbon footprint.

- **Design ML with resource-awareness**:
  - to optimize both performance and sustainability.

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Responsibility

- **Accountability** in AI hardware–software co-design.
  - ensuring that both model and hardware choices are transparent and justified.

- Ensure **reproducibility** of ML on FPGAs.
  - enabling consistent results across platforms.

- Promote responsible open-source use.
  - fostering collaboration without compromising ethics or safety.

- Emphasize the responsibility to society: aim not only for faster AI, but for better, fairer, and more human-centered AI systems.

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