



Wasted Large Language Models: A life cycle thinking approach

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Motivation

What if we treated LLMs as products
that can become waste?



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EU's Waste Framework Directive

Waste hierarchy



Can this be applied to immaterial products?

EU's Waste Framework Directive

Waste:

Any substance or object which the holder discards or intends to discard

An LLM becomes waste when it is discarded and no longer used

Main aim of paper

How can waste management concepts help us
reduce wasted development costs?

Reducing climate impact by reducing LLM waste

- Environmental impact from LLMs' energy usage comes from:
 - Developing
 - Storing
 - Moving
 - Using

Prevention and reuse

- Prevention is mainly achieved through reuse
- Software in general is reused at enormous scale
- The greatest barrier for reuse is deprecation, not wear
- Sufficiency: what can be considered good enough?
- Augment instead of retrain: RAG, agent skills

Recycle and recovery

- Recycling: reprocessing waste into new products
- Recovery: waste continues to serve a useful purpose
- For LLMs: any method that extends or adapts existing models
- Fine-tuning, LoRA adapters and adapter libraries, model merging
- Quantization and pruning: fit models to the resources you have
- Weakness: LLMs require much more complex techniques to recycle than code

Disposal

- No disposal in the traditional sense – models can simply be deleted, without residue
- But file storage consumes energy, and an LLM can be a few to several hundred GB
- Deleting unused models is a real saving
- Disposal at no cost breeds a throwaway mentality

Prevention of unnecessary use of LLMs

- Two kinds of waste: wasting the model, and wasting energy in use
- Using an LLM where a much more efficient tool would do
- Huge potential for energy savings, given the footprint of inference at scale
- A gap in HCI: nothing in the interface helps the user avoid needless use
- On the contrary: dark patterns steer users towards using LLMs

How to deal with LLM waste?

- Avoiding the training of new models is one of the main levers
- New models are necessary to improve performance
- Understanding when it is worth training a new model is crucial
- Are LLMs worth the cost at all?
- Difficult to incentivise sufficiency in a growth-based economy

Key take-aways

- Reframing LLMs as products that become waste can change how we treat them
- The waste hierarchy gives us a vocabulary: reuse, recycle, recover
- Prevention is the easiest and most effective step
- LLMs are hard to recycle, compared to ordinary software
- Deprecation and disposal are free, which hides the production cost



Thank you for attending!



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