

- Requirements Engineering for AI

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● Requirements Engineering (RE)

○ What is it?

It is the process of defining, documenting, and maintaining requirements in the engineering design process.

○ What are some common RE activities?

- Elicitation
- Analysis
- Specification
- Validation

- Types of Requirements

	Functional (FR)	Non-functional (NFR)
Expressed as	"System must do <requirement>"	"System shall be <requirement>"
Capturing type	Captured in use cases	Captured as quality attributes
Example	System X must send a confirmation email when a user places an order	Emails should be sent with a latency of no greater than 12 hours

- Exercise: Ticket Sales System

- **Functional or non-functional requirement?**

- Users must be able to browse for events by name, date, or venue. FR
- All data is to be backed up nightly. NFR (backup)
- Users must be able to purchase tickets 24/7. — NFR (performance)
FR

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*Is the current RE process relevant
for ML systems?*

● FRs for ML Systems

○ How FRs different for ML systems?

- The purpose of ML systems is more focused (recognize face, detect spam)
- Hence, ML systems have far fewer FRs



I consider predictive power as functional requirement

Accuracy?

Precision?

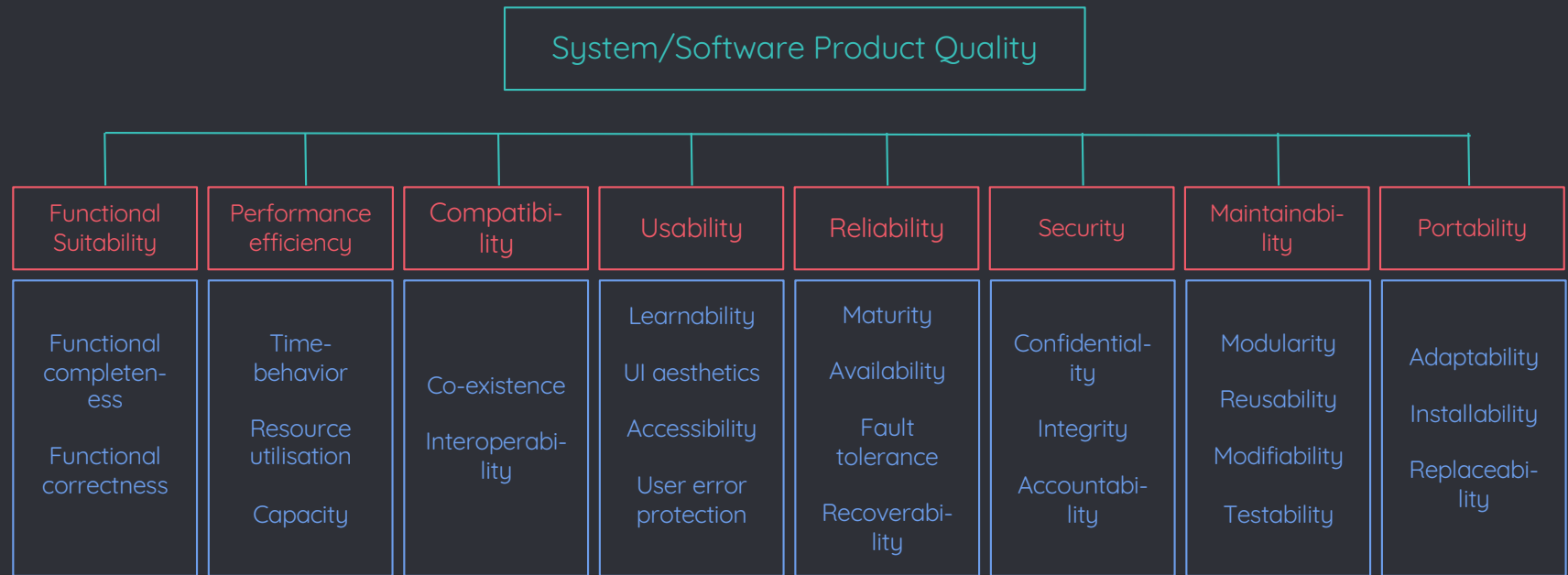
Recall?

F1?

○ Impact on RE

- Must understand performance measures and identify the appropriate one based on the problem domain and stakeholder demands.

• Conventional NFRs



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Are these NFRs relevant for ML-based systems?

● Explainability

○ Why is it more critical for ML systems?

- Behavior is no longer explicitly encoded in source code.
- Behavior is now **learned** from training data and loss function.

○ Challenges

- Depends on the model (Naives Bayes vs. neural network)
- What needs to be explained?
- Predictive power vs. explainability trade-off

○ Impact on RE

- Should elicit explainability requirements from a user's point of view

● Freedom from Discrimination (Fairness)

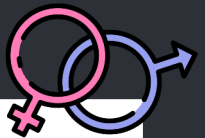
○ What is discrimination in ML-systems?

- ML systems are designed to discriminate
- They learn patterns from training data and use it to judge about unseed data
- Problem: some discriminations are **unaccepted** by society or law (gender, race)

○ Why is it more critical in ML systems?

- It is more implicit
- It is **amplified**

2 Is this enough???



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Amazon Scraps Secret AI Recruiting Tool That Showed Bias Against Women

gender proxy = school

● Legal Requirements

○ Example

- General Data Protection Regulation (GDPR): **personal data** can only be used in ways specified by an **explicit consent**.

○ Challenges

- Hard to predict which features will be **useful**
- Dealing with **revoked consent** is non-trivial

○ Impact on RE

- Must stay up to date with legal requirements. Must ensure no illegal features are used.

● Data Requirements

○ Quantity

- More data = better
- More diversity = better
- Constraints in regulated domains
Ex: ≥ 5 years of data
required to predict loan losses

Impact on RE

- Should identify additional data sources during stakeholder analysis

Quality

- Completeness
- Consistency
- Correctness
Influenced by data collection

Impact on RE

- Should identify and specify requirements about data collection, data formats, and ranges of data

● Closing Remarks

○ Future Research Directions

- Create a catalogue of NFRs for ML systems
- Create operationalizations and measure for NFRs
- Explore quality trade-offs in ML systems

○ Exercise: Can you identify any quality trade-off?

- Explainability
- Freedom from discrimination
- Legal requirements
- Data requirements

? Questions

● References

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