**General**

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| --- | --- | --- | --- | --- |
| ID[[1]](#endnote-1) |  | | | |
| Use case name | Generative design of mechanical parts | | | |
| Context | Manufacturing | | | |
| Application domain | On-premise systems | | | |
| Status | In operation | | | |
| Contributor | Name | Affiliation | Contact | |
|  |  |  | |
| Scope[[2]](#endnote-2) | Help mechanical engineers design lighter, strong, better parts | | | |
| Objective(s) | Create optimized parts following precise mechanical constraint while permitting cost savings by reducing the amount of material necessary to achieve goals. | | | |
| Narrative | Short description (not more than 150 words) | From Wikipedia: Generative design is an iterative design process that involves a program that will generate a certain number of outputs that meet certain constraints, and a designer that will fine tune the feasible region by changing minimal and maximal values of an interval in which a variable of the program meets the set of constraints, in order to reduce or augment the number of outputs to choose from. | | |
| Complete description | <https://en.wikipedia.org/wiki/Generative_design>  <https://www.autodesk.com/solutions/generative-design>  <http://www.newequipment.com/research-and-development/what-generative-design-and-why-its-future-manufacturing> | | |
| Key performance indicators (KPIs) | ID | Name | Description | Reference to mentioned use case objectives |
| 1 | Weight reduction | Is the resulting part lighter than original version | Use less material |
| 2 | Mechanical constraints metrics | Various mechanical metrics | Obtain strong, better parts |
|  |  |  |  |
| AI features | Task(s) | Optimization | | |
| Method(s)[[3]](#endnote-3) | Genetic algorithms, optimisation algorithms, generative adversarial networks | | |
| Hardware[[4]](#endnote-4) | CPU, GPU | | |
| Terms and concepts used[[5]](#endnote-5) | Design, generative adversarial network, genetic algorithm, mimicry | | |
| Challenges and issues | Challenges: Environment may be cluttered, occlusions of target might occur, objects may move around. Issues: For safety reasons, speed and force of robot need to be limited in assistive environment to avoid harm. Human intervention can happen at any time. | | | |
| Societal  concerns |  | | | |

**Data (optional)**

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| --- | --- |
| Data characteristics | |
| Description |  |
| Source[[6]](#endnote-6) |  |
| Type[[7]](#endnote-7) |  |
| Volume (size) |  |
| Velocity (e.g. real time)[[8]](#endnote-8) |  |
| Variety (multiple datasets)[[9]](#endnote-9) |  |
| Variability  (rate of change)[[10]](#endnote-10) |  |
| Quality[[11]](#endnote-11) |  |

**Process scenario (optional)**

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| Scenario conditions | | | | | |
| No. | Scenario name | Scenario description | Triggering event | Pre-condition[[12]](#endnote-12) | Post-condition[[13]](#endnote-13) |
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**Training (optional)**

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| Scenario name | Training | | | | |
| Step No. | Event[[14]](#endnote-14) | Name of process/Activity[[15]](#endnote-15) | Primary actor | Description of process/activity | Requirement |
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| Specification of training data[[16]](#endnote-16) | |  | | | |

**Evaluation (optional)**

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| Scenario name | Evaluation | | | | |
| Step No. | Event[[17]](#endnote-17) | Name of process/Activity[[18]](#endnote-18) | Primary actor | Description of process/activity | Requirement |
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| Input of evaluation[[19]](#endnote-19) | |  | | | |
| Output of evaluation[[20]](#endnote-20) | |  | | | |

**Execution (optional)**

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| Scenario name | Execution | | | | |
| Step No. | Event[[21]](#endnote-21) | Name of process/Activity[[22]](#endnote-22) | Primary actor | Description of process/activity | Requirement |
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| Input of Execution[[23]](#endnote-23) | |  | | | |
| Output of Execution[[24]](#endnote-24) | |  | | | |

**Retraining (optional)**

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| Scenario name | Retraining | | | | |
| Step No. | Event[[25]](#endnote-25) | Name of process/Activity[[26]](#endnote-26) | Primary actor | Description of process/activity | Requirement |
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| Specification of retraining data[[27]](#endnote-27) | |  | | | |

**References**

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| References | | | | | | |
| No. | Type | Reference | Status | Impact on use case | Originator/organization | Link |
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**Footnote**

1. Leave this cell blank. [↑](#endnote-ref-1)
2. The scope defines the limits of the use case. [↑](#endnote-ref-2)
3. AI method(s)/framework(s) used. [↑](#endnote-ref-3)
4. Hardware system used. [↑](#endnote-ref-4)
5. Terms and concepts listed here can be used to extend the work of WG 1 (AWI 22989 and AWI 23053) as necessary. [↑](#endnote-ref-5)
6. Origin of data, which could be from instruments, IoT, web, surveys, commercial activity, or from simulations. [↑](#endnote-ref-6)
7. Structured/unstructured Images, voices, text, gene sequences, and numerical. Composite: time-series, graph-structured [↑](#endnote-ref-7)
8. The rate of flow at which the data is created, stored, analysed, or visualized. [↑](#endnote-ref-8)
9. Data from a number of domains and a number of data types. The wider range of data formats, logical models, timescales, and semantics complicates the integration of the variety of data. [↑](#endnote-ref-9)
10. Changes in data rate, format/structure, semantics, and/or quality. [↑](#endnote-ref-10)
11. Completeness and accuracy of the data with respect to semantic content as well as syntactical of the data (such as presence of missing fields or incorrect values) [↑](#endnote-ref-11)
12. Describe which condition(s) should have been met before this scenario happens. [↑](#endnote-ref-12)
13. Describe which condition(s) should prevail after this scenario happens. The post-condition may also define "success" or "failure" conditions. [↑](#endnote-ref-13)
14. The event that triggers the step. This might be completion of the previous event. [↑](#endnote-ref-14)
15. Action verbs should be used when naming activity. [↑](#endnote-ref-15)
16. Training data can be further specified. [↑](#endnote-ref-16)
17. The event that triggers the step. This might be completion of the previous event. [↑](#endnote-ref-17)
18. Action verbs should be used when naming activity. [↑](#endnote-ref-18)
19. Specify input of evaluation. [↑](#endnote-ref-19)
20. Specify output of evaluation. [↑](#endnote-ref-20)
21. The event that triggers the step. This might be completion of the previous event. [↑](#endnote-ref-21)
22. Action verbs should be used when naming activity. [↑](#endnote-ref-22)
23. Specify input of evaluation. [↑](#endnote-ref-23)
24. Specify output of evaluation. [↑](#endnote-ref-24)
25. The event that triggers the step. This might be completion of the previous event. [↑](#endnote-ref-25)
26. Action verbs should be used when naming activity. [↑](#endnote-ref-26)
27. Retraining data can be further specified. [↑](#endnote-ref-27)