Allocating resource & to find the off spring humanware as sponsor based on the computational consequence of artificial Feed-forward Backpropagation Neural Network and Genetic Algorithm

B.Sc. Dissertation

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Presentation Venue: Department of CSE
IBAIS University

Date: Tuesday, December 10, 2019, 1300 hours

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Abstract

Epistemic virtues and cognitive responsibility is the next generation industrial magnet. To come to such emerging software engineering trend and technology, artificial intelligence explores the new age of civilization, industrial, corporate culture and precise decision making & research industry. Artificial Intelligence is a diverse field of study in which machine learning algorithms acts as the cogwheel. During the literal eventual journey of academic project and this document, the artificial intelligence is the key factor to compile the software engineering projects and the managing such projects. Neural Network is the simplest version of artificial intelligence and machine learning algorithm compare to the cutting-edge applications in human era. To progress the project, the feed-forward neural network with prominent backpropagation algorithm is being used to predict the estimate of the most precise resource i.g. space of a premises, duration of stay in the premises, life style of the client, premises type and how much client can expense. With impeccable loss or cost function and accuracy score, the application can act like a stand-alone application. Though, this application takes higher memory and space while calculation & dataset is small related to the industrial scale, the feed-forward based backpropagation algorithm explains what the management seeking for to come to an evidence based decision. In the second stage of development, the genetic algorithm has been used using python's tpot model, with which the organization has find the manager as sponsor the client during the client's stay in their respected premises. Using this model takes much higher execution time to implement in Java Enterprise based WebApp. With active communication and supervising, supervised learning as part of machine learning task and software engineering theory, practice and project management paradigm(CMMI, PCMM, SCRUM) along with J2EE-MVC architecture and Apache Tomcat Server, the project conclusively outputed the expected scope of our work and predicted results. Limitations and hazards of severity are marginal during the compilation. Future work on this study belongs to large scale mature computing environment and for those who wants to be the part of next generation of innovation in diversity and dynamic decision making system. This software application as well as the dissertation is the path of future or next era of our living civilization.

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Scopes of the dissertation

Using Artificial Intelligence, Machine Learning Algorithms, Feed-forward Neural Network, Backpropagation Algorithm, Genetic Algorithm, Resource Allocation, Prediction, J2EE, MVC, Apache TomCat Server, SCRUM, CMMI, PCMM, Large Scale Computation the main propositional statement of the project and this dissertation has been prepared. The core project and purposes of this dissertation is based on the following five propositions which is complete data driven perspectives:

- Proposition 1: Arrangement of the resource
  In this phase, all the resources like rooms, client information, inventory will be collected for next calculation.
- Proposition 2: Clustering demand & supply
  Finding the client's demand, the host organization will cluster or find suitable similar resource pool before assign the resource and employee to the client as the client's personal guide or host manager.
- Proposition 3: Finding the predicted resource
  Using neural network with backpropagation algorithm, the most higher estimated resources will be allocated to the client.
- Proposition 4: Finding sponsor by automated machine learning algorithm
  Using Genetic Algorithm and Python TPOT, the predicted employee who is most matched for that specific client will be assigned to host as manager during the life cycle of the client under the hood of the organization.
- Proposition 5: Allocating predicted resources from above Finally, the predicted available resources will comes out and predicted employee details will be released for the client.

The complete process is automated and machine generated, so the hazard is quite less and the process is time sensitive calculations.

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Objectives of the dissertation

- To find the resource using feed-forward backpropagation algorithm. Here, resource refers to premises, humanware and so related.
- To find the sponsor who will host the client using genetic algorithm.
- To use mix (qualitative and quantitative research methods) methods.
- To use SCRUM as Agile methodology.
- To use emergency technology entitled in software project management and documenting this dissertation.
- To use face-face agile communication as communication framework.

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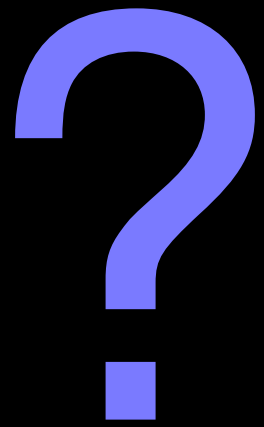
Queries about Purpose and Objectives of the project



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Literature

Literature has been detailed in the dissertation.

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Some questions about literature

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Research Methodology

Mix Methodology (used both qualitative and quantitative methodology)

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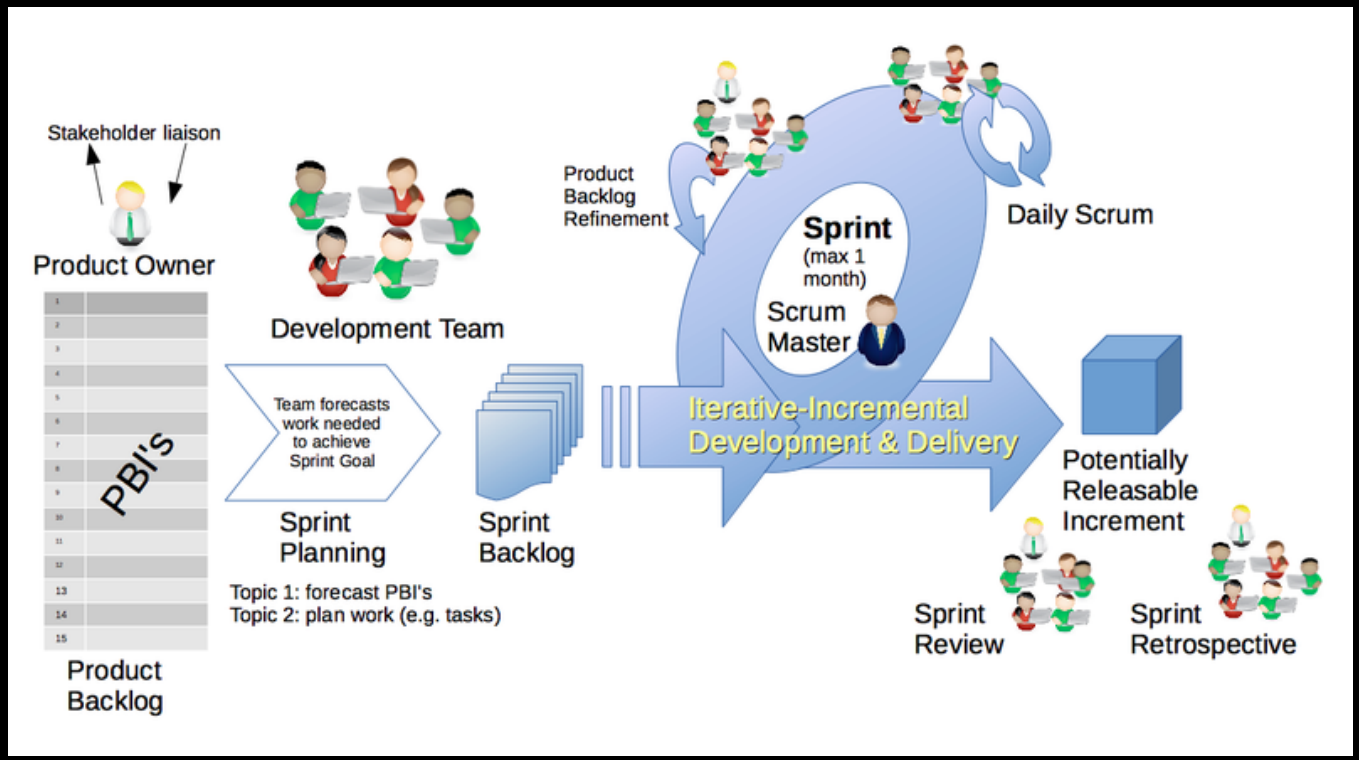
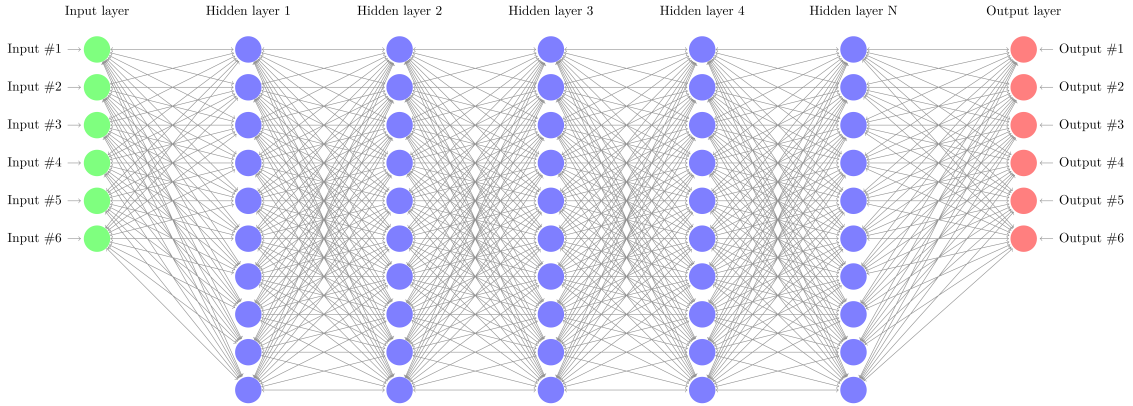
SCRUM Project as Agile Software Development



Python: Feed-forward based Backpropagation Algorithm



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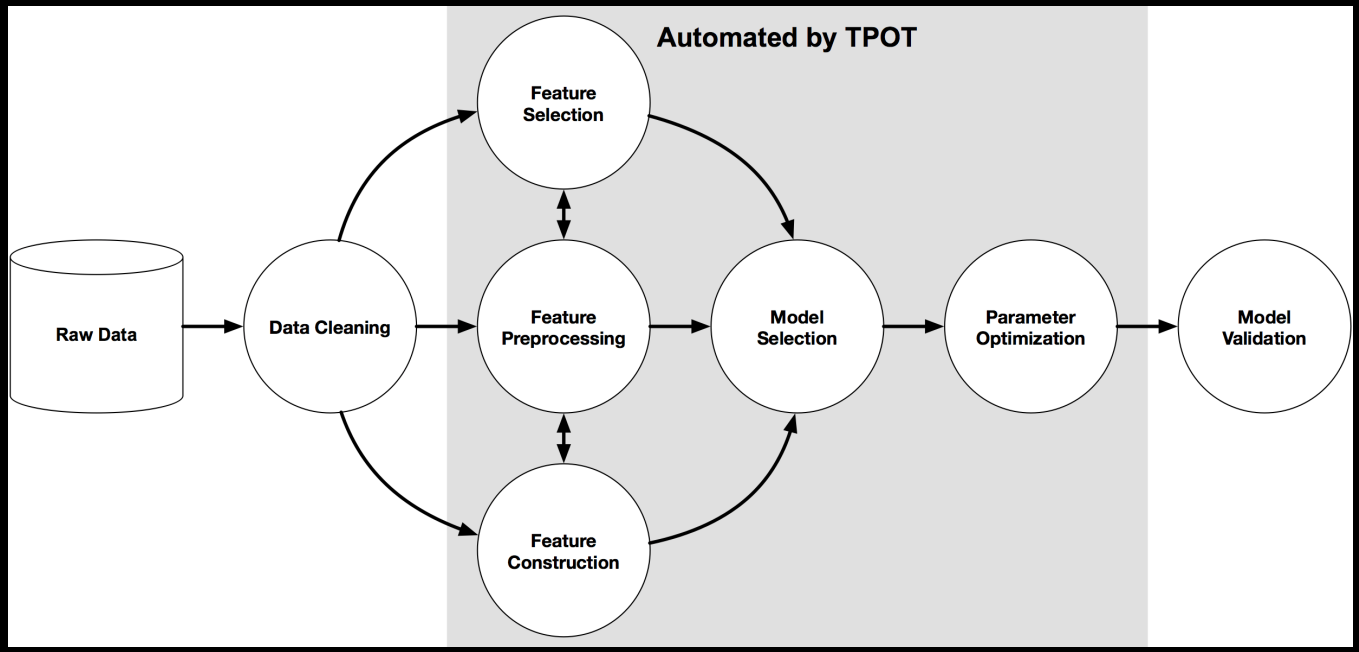
Python TPOT: Genetic Algorithm



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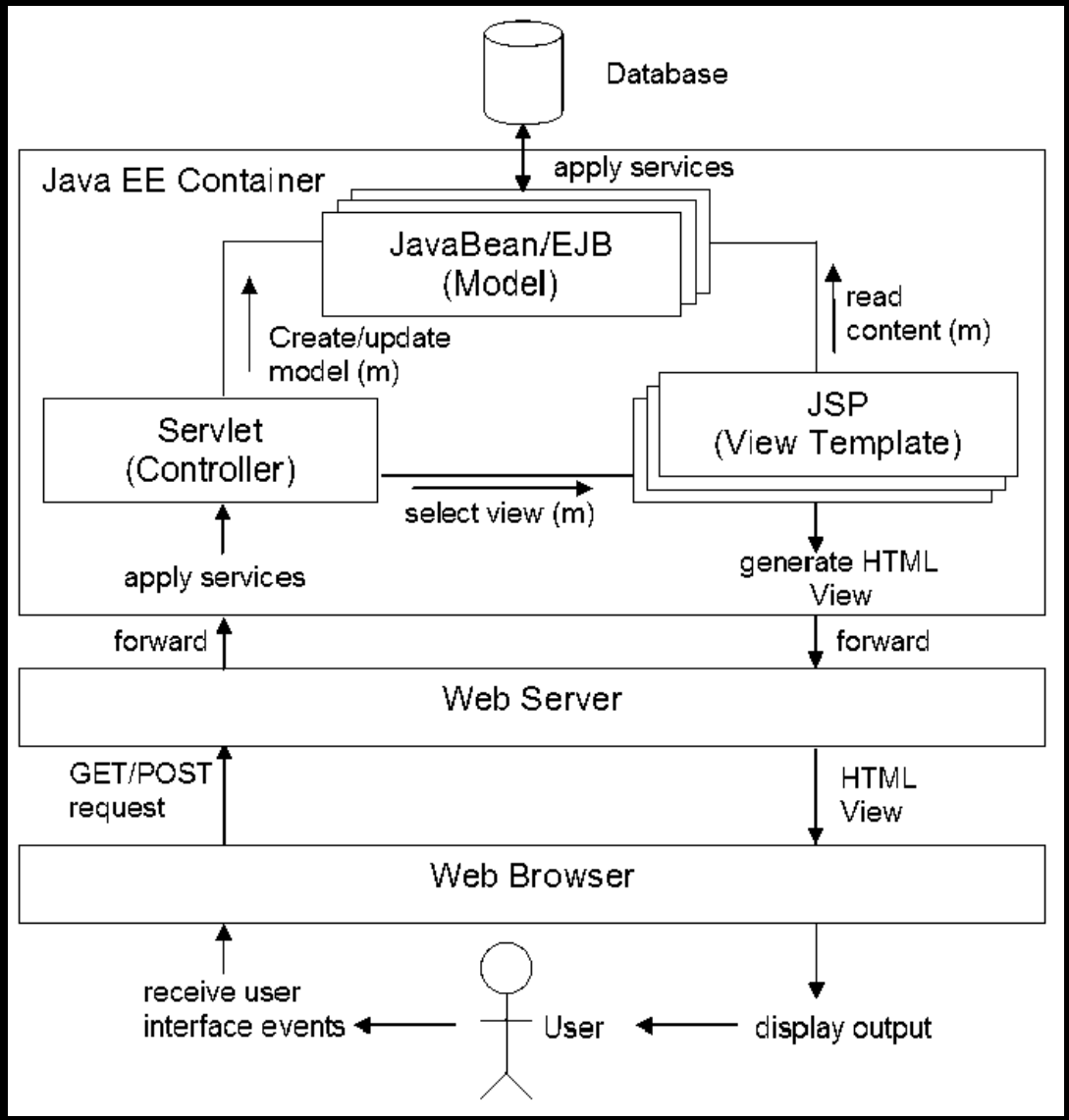
J2EE: Distributed MVC N-tier Architecture, Apache TomCat Servers



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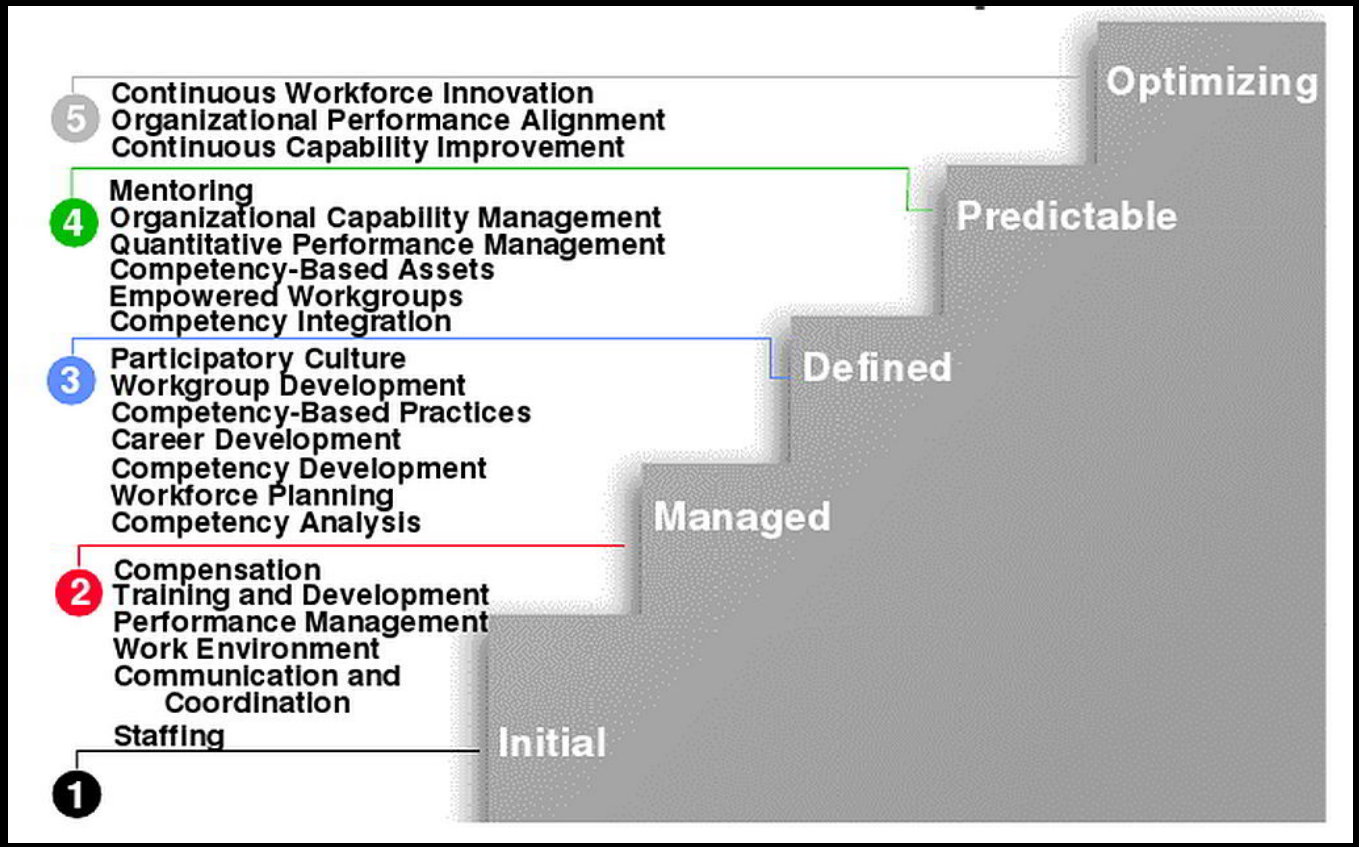
People Capability Maturity Model(PCMM)



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Input1: Feed-forward based Backpropagation Algorithm

```
# INPUT 1:
# Historical Data of Client

stay,  expense,    social status,  reservation status,
emmployee_oee_score
1,     1000,       1,                1,
100,                          10
1,     800,        2,                1,
80,                           10
1,     600,        3,                1,
60,                           7
1,     700,        1,                1,
50,                           7
1,     10000,      1,                1,
100,                          100
.....................................................
.....................................................
23,    6000,       5,                5,
17,                           93
24,    5000,       6,                6,
7,                            92
```

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Input2: Feed-forward based Backpropagation Algorithm

```
# INPUT 2:
# Ranking of each row/client's historical data

ranking
100
80
60
100
180
....
....
99
100


# INPUT 3:
# Primary Input

stay, expense, social status, reservation status,
emmployee_oee_score
25, 1, 1, 0,
98, 0
```

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Output: Feed-forward based Backpropagation Algorithm

```
==================================================
Results:
==================================================
Will stay in the hotel:
0.9975548366026425
Will expense:
992.0554075024014
Client's life stle status:
99.06087862418 32
Room type:
9.984109264400264
Client reputation score:
99.25137288175236
Employee OEE score:
99.60083548721165
==================================================
Error or loss in 1000 epoch
==================================================
0.2204536808552 7617
==================================================

F1 Score:
0.19601353361615725
```

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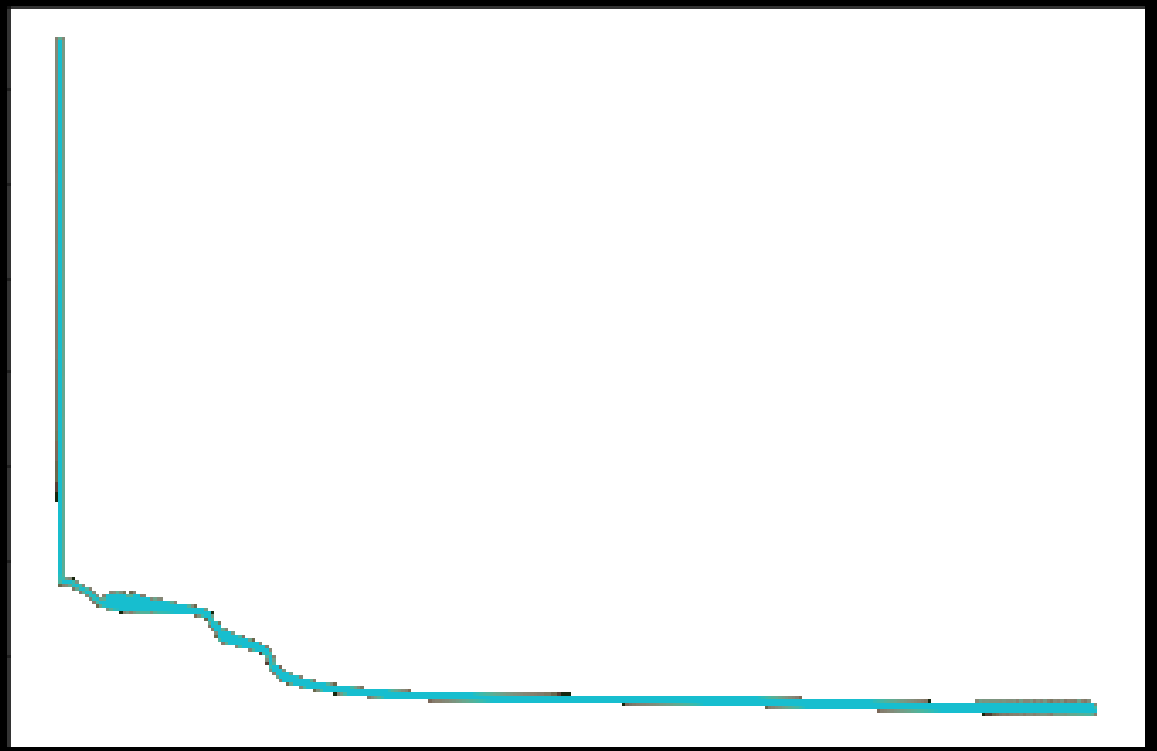
Cost function



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Input1: Genetic Algorithm

```
# INPUT 1:
# Historical Data: Employee Details with OEE Score

Employee id,Employee name,Client_Stays,Room_Status,Client_quality_score,Working_hours,
Availability_score,Quality,Performance,Reliability_score,OEE_score
1,A,10,VIP,80,7,58.33,119.58,58.33,82.7,79.74
1,A,9,Business,75,5,41.67,107.42,41.67,85.81,69.14
1,A,8,Business,75,4,33.33,95.33,33.33,87.99,62.5
1,A,7,CIP,85,8,66.67,83.67,66.67,86.94,75.98
1,A,6,High,70,,0,71,0,93.05,41.01
.....
.....
5,D,8,Business,79,6,50,95.5,50,86.59,70.52
5,D,27,Average,61,8,66.67,323.67,66.67,58.27,128.82
5,D,15,Business,72,5,41.67,179.42,41.67,77.49,85.06
5,D,5,Below,55,7,58.33,59.58,58.33,90.94,66.8
```

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Input2: Genetic Algorithm

```
# INPUT 2:
# Historical Data: Sales/Profit Per Employee Made with each client

Employee id,Employee name,Client_Stays,Room_Status,Client_quality_score,Working_hours,
Availability_score,Quality,Performance,Reliability_score,OEE_score,Profit
1,A,10.00,VIP,80.00,7.00,58.33,119.58,58.33,82.70,79.74,90000
1,A,9.00,Business,75.00,5.00,41.67,107.42,41.67,85.81,69.14,72000
1,A,8.00,Business,75.00,4.00,33.33,95.33,33.33,87.99,62.50,64000
1,A,7.00,CIP,85.00,8.00,66.67,83.67,66.67,86.94,75.98,70000
1,A,6.00,High,70.00,,0.00,71.00,0.00,93.05,41.01,42000
.........................................
.........................................
5,D,3.00,High,73.00,4.00,33.33,35.33,33.33,95.31,49.33,21000
5,D,8.00,Business,79.00,6.00,50.00,95.50,50.00,86.59,70.52,64000
5,D,27.00,Average,61.00,8.00,66.67,323.67,66.67,58.27,128.82,162000
5,D,15.00,Business,72.00,5.00,41.67,179.42,41.67,77.49,85.06,120000
5,D,5.00,Below,55.00,7.00,58.33,59.58,58.33,90.94,66.80,25000
```

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Output: Genetic Algorithm

```
==============================
Details of the Sponsor
==============================
Profit                193506
Employee id                1
Employee name              A
OEE_score            11.6589
Client_Stays              31
Room_Status                1


Cross validation score
-27617860.591307577
```

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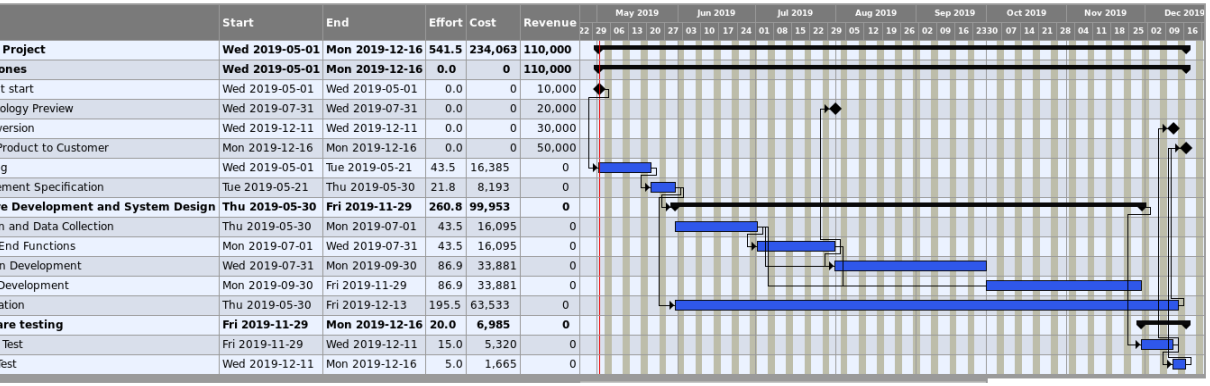
Project Schedule

WBS	Name	Start	End	Effort	Cost	Revenue
1	**CSE400 Project**	**Wed 2019-05-01**	**Mon 2019-12-16**	**541.5**	**234,063**	**110,000**
1.6	**Milestones**	**Wed 2019-05-01**	**Mon 2019-12-16**	**0.0**	**0**	**110,000**
1.6.1	Project start	Wed 2019-05-01	Wed 2019-05-01	0.0	0	10,000
1.6.2	Technology Preview	Wed 2019-07-31	Wed 2019-07-31	0.0	0	20,000
1.6.3	Beta version	Wed 2019-12-11	Wed 2019-12-11	0.0	0	30,000
1.6.4	Ship Product to Customer	Mon 2019-12-16	Mon 2019-12-16	0.0	0	50,000
1.1	Planning	Wed 2019-05-01	Tue 2019-05-21	43.5	16,385	0
1.2	Requirement Specification	Tue 2019-05-21	Thu 2019-05-30	21.8	8,193	0
1.3	**Software Development and System Design**	**Thu 2019-05-30**	**Fri 2019-11-29**	**260.8**	**99,953**	**0**
1.3.1	Design and Data Collection	Thu 2019-05-30	Mon 2019-07-01	43.5	16,095	0
1.3.4	Back-End Functions	Mon 2019-07-01	Wed 2019-07-31	43.5	16,095	0
1.3.2	Python Development	Wed 2019-07-31	Mon 2019-09-30	86.9	33,881	0
1.3.3	J2EE Development	Mon 2019-09-30	Fri 2019-11-29	86.9	33,881	0
1.5	Dissertation	Thu 2019-05-30	Fri 2019-12-13	195.5	63,533	0
1.4	**Software testing**	**Fri 2019-11-29**	**Mon 2019-12-16**	**20.0**	**6,985**	**0**
1.4.1	Alpha Test	Fri 2019-11-29	Wed 2019-12-11	15.0	5,320	0
1.4.2	Beta Test	Wed 2019-12-11	Mon 2019-12-16	5.0	1,665	0



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Project Cost

Title of the program	Lines of Code	Error or loss or CV	Note
findingSponsor.ipynb	94	Loss = 0.17	Generation 10, population 50
Feed-forward Backpropagation NeuralNetwork.ipynb	60	CV = -27617860.591307577	Input layer 6, Output layer 6, Hidden layer 10
Neural Network FeedForward Backpropagation.py	72		Core NN Engine
Designing diagram	109		List of figures
Designing system view	80		Basic system view
Schedule of the project	500		Sample schedule for Agile Methodology
Total LoC score in thousand	0.915		

Table: Results: Lines of Code in the application development

Cost Factor	Very Low	Low	Normal	High	Very High	Extra High
Product Complexity (EAF)	0.70	0.85	1.00	1.15	1.30	1.65

Table: Results: Cost Factor

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Project Cost (following)

Category	a_b	b_b	c_b	d_b
Organic	3.2	1.05	2.5	0.38
Semidetached	3.0	1.12	2.5	0.35
Embedded	2.8	1.2	2.5	0.32

Table: Results: System types

Factors	Results	Measurement unit
Effort	3.53066272382387	Person per month
Development time	3.88767265623533	Months
Labor rate	15000	USD/m
Productivity	259.158144397608	LoC per person per month
Average staffing per month	0.908168726130052	Full time software personnel
Cost of the project	205890.913946991	USD

Table: Results: Estimate Effort, Development time, Productivity and Cost of the application

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Tools and System Used

Components	Entitle
Processor	GPU Processor
Architecture	$x86_64$
CPU op-mode(s)	32-bit, 64-bit
CPU(s)	4
Model name	Intel(R) Core(TM) i5-4210U CPU @ 1.70GHz
CPU MHz	2394.466
L1d cache	32K
L1i cache	32K
L2 cache	256K
L3 cache	3072K
Browser	Firefox, localhost:80
Operating System	Linux, Unix

Table: Platform for the project

Category	Entitle
Development	Python, Jupyter Notebook, Java Development Kit, Netbeans, PlantUML, TaskJuggler
Application runtime	Linux Kernel, Java Runtime Environment
Database	MySql
Web Application	Apache Tomcat Server
Security	Spring Security, SSL, HTTPS Authentication, Encrypt Password, Form-based Authentication
Platform	J2EE, Linux, Unix, MySql, GNU, $x86_64$

Table: Methodology: Software Framework

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Project Risk and Scale

The project risk categorize as **marginal** which effects the components verily: the technical performance very low, has responsive software support, has sufficient financial support and goes through a realistic, achievable schedule.

Category \ Components		Performance	Support	Cost	Schedule
Catastrophic	1	Failure to meet the requirement would result in mission failure		Failure results in increased costs and schedule delays with expected values in excess of $500K	
	2	Significant degradation to nonachievement of technical performance	Nonresponsive or unsupportable software	Significant financial shortages, budget overrun likely	Unachievable IOC
Critical	1	Failure to meet the requirement would degrade system performance to a point where mission success is questionable		Failure results in operational delays and/or increased costs with expected value of $100K to $500K	
	2	Some reduction in technical performance	Minor delays in software modifications	Some shortage of financial resources, possible overruns	Possible slippage in IOC
Marginal	1	Failure to meet the requirement would result in degradation of secondary mission		Costs, impacts, and/or recoverable schedule slips with expected value of $1K to $100K	
	2	Minimal to small reduction in technical performance	Responsive software support	Sufficient financial resources	Realistic, achievable schedule
Negligible	1	Failure to meet the requirement would create inconvenience or nonoperational impact		Error results in minor cost and/or schedule impact with expected value of less than $1K	
	2	No reduction in technical performance	Easily supportable software	Possible budget underrun	Early achievable IOC

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Limitations

- Software hazards occurs while maintaining higher generations in genetic algorithm which considered as major severity and likelihood of the occurrence is probable.
- Costs is estimated higher cause of technical and research skills.
- Optimized model takes enough time:
  - Genetic algorithm takes 4+ hours in CPU for real world implementation
  - Feed forward backpropagation algorithm takes 10-15+ hours in GPU
- Need team work instead individual effort.
- Literary possible but industrially incomplete because of the inefficient loss function.
- Not enough library access for content and bibliography.
- Ethical standards and legislation are not industrially exercised.
- Halting problem.
- Takes enough memory and space.
- Complexity is very high.
- Big O notation is complex to calculate.
- Sound knowledge does not exist to the owners to purchase such application.
- Integration of Python and J2EE is a highly complex procedure.
- Industrial dataset is not publicly available.
- Carbon footprints are large in size.

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Software Engineering Ethics

Software engineering has evolved into a respected, worldwide profession. As professionals, software engineers should abide by a code of ethics that guides the work that they do and the products that they produce. An ACM/IEEE-CS Joint Task Force has produced a Software Engineering Code of Ethics and Professional Practices (Version 5.1). The code states:
Software engineers shall commit themselves to making the analysis, specification, design, development, testing and maintenance of software a beneficial and respected profession. In accordance with their commitment to the health, safety and welfare of the public, software engineers shall adhere to the following eight principles:

- Public
- Client and Employer
- Product
- Judgment
- Management
- Profession
- Colleagues
- Self

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Key Impacts

- Impacting nearly every technological aspect of society.
- Environmental impact in climate change and change management.
- Fewer errors.
- Able to perform repetitive tasks.
- Difficulty exploration with continuity with greater responsibility.
- Artificial thinker and decision surfer.
- Can available $24 \times 7 \times 365$
- Domain and industrial expert and advisor.

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Future

The future of this project is:

- Automated industrial live software application which may be implemented in health-care, hospitality, manufacturing, sales-engineering, dynamic decision making

Such application is for those who belongs to the competitive edge of technology to sustain in the highly trendy, large scale competition and production with market research and searching & asking for real time decision making environment.

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Supervisor's Session

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Thank you!