[Syllabus] AI Learning Ecosystem

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Level	Quantity
Junior	43
Experience	22
Senior	14
Expert	7

Theory	Lý thuyết
Quizz	Câu hỏi trắc nghiệm
PA (Programming Assignment)	Bài tập lập trình
Example	Ví dụ mẫu

1 A. Syllabus:

			Skill	Level	Resource
1. Career Navigation			ML/DL vs Data science, Researcher vs Engineer	**Junior**	Theory + Quizz: https://www.coursera.org/learn/ai-for-everyone
2. Security			Security on Web Development	**Junior**	Theory + Quizz + PA: Chương trình "An Toàn Thông Tin" của VCS
3. Programming	Language	Python	Basic	**Junior**	PA: https://www.hackerrank.com/domains/python
			Duck Typing	**Junior**	Theory + Example: https://www.geeksforgeeks.org/duck-typing-in-python/
			Meta Programming	**Senior**	Theory + Example: https://www.geeksforgeeks.org/metaprogramming-metaclasses-python/
		Scala		**Junior**	Theory + Example: https://www.geeksforgeeks.org/scala-tutorial-learn-scala-with-step-by-step-guide/
		Go		**Junior**	Theory + Example: https://www.w3schools.com/go/
	Design Pattern		Singleton Pattern	**Junior**	Theory + Example: https://www.tutorialspoint.com/python_design_patterns/python_design_patterns_singleton.htm
			Template Pattern	**Experience**	Theory + Example: https://www.tutorialspoint.com/python_design_patterns/python_design_patterns_template.htm
			Decorator Pattern	**Experience**	Theory + Example: https://www.tutorialspoint.com/python_design_patterns/python_design_patterns_decorator.htm
			Advance DP	**Senior**	Theory + Example: https://www.geeksforgeeks.org/python-design-patterns/
	Regex		Basic	**Junior**	PA: https://www.hackerrank.com/domains/regex?filters%5Bsubdomains%5D%5B%5D=re-introduction
			Applications	**Junior**	PA: https://www.hackerrank.com/domains/regex?filters%5Bsubdomains%5D%5B%5D=re-applications
4. Database	SQL		Basic	**Junior**	Theory + Example: https://www.w3schools.com/sql/
	NoSQL	Elastic Search	Basic	**Junior**	Theory + Example: https://www.tutorialspoint.com/elasticsearch/index.htm

			Skill	Level	Resource
		Mongo DB	Basic	**Junior**	Theory + Example: https://www.tutorialspoint.com/mongodb/index.htm MongoDB Tutorial MongoDB - Home MongoDB - Overview MongoDB - Advantages MongoDB - Environment MongoDB - Data Modeling MongoDB - Create Database MongoDB - Drop Database MongoDB - Create Collection MongoDB - Drop Collection MongoDB - Data Types MongoDB - Insert Document MongoDB - Query Document MongoDB - Update Document MongoDB - Delete Document
			Intermediate	**Experience**	Theory + Example: https://www.tutorialspoint.com/mongodb/index.htm MongoDB - Projection MongoDB - Limiting Records MongoDB - Sorting Records MongoDB - Indexing MongoDB - Aggregation MongoDB - Replication MongoDB - Sharding MongoDB - Create Backup MongoDB - Deployment
			Advance	**Senior**	Theory + Example: https://www.tutorialspoint.com/mongodb/mongodb_relationships.htm

<table>
<tr><th></th><th></th><th></th><th>Skill</th><th>Level</th><th>Resource</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Advanced MongoDB
MongoDB - Relationships
MongoDB - Database References
MongoDB - Covered Queries
MongoDB - Analyzing Queries
MongoDB - Atomic Operations
MongoDB - Advanced Indexing
MongoDB - Indexing Limitations
MongoDB - ObjectId
MongoDB - Map Reduce
MongoDB - Text Search
MongoDB - Regular Expression
Working with Rockmongo
MongoDB - GridFS
MongoDB - Capped Collections
Auto-Increment Sequence</td></tr>
<tr><td colspan="3">5. Big Data</td><td>Basic</td><td>Junior</td><td>Theory + Quizz: https://www.coursera.org/learn/big-data-introduction?specialization=big-data
Theory + Quizz: https://www.coursera.org/learn/introduction-to-big-data-with-spark-hadoop</td></tr>
<tr><td colspan="3"></td><td>Data Management & Modeling</td><td>Experience</td><td>Theory + Quizz: https://www.coursera.org/learn/big-data-management?specialization=big-data</td></tr>
<tr><td colspan="3"></td><td>Data Integration & Processing</td><td>Senior</td><td>Theory + Quizz https://www.coursera.org/learn/big-data-integration-processing?specialization=big-data</td></tr>
<tr><td colspan="3"></td><td>Graph Analytics</td><td>Senior</td><td>Theory + Quizz https://www.coursera.org/learn/big-data-graph-analytics?specialization=big-data</td></tr>
<tr><td>6. Tool</td><td>Kafka</td><td></td><td>Basic</td><td>Junior</td><td>Theory: https://www.youtube.com/watch?v=U4y2R3v9tlY</td></tr>
<tr><td></td><td>Redis</td><td></td><td>Basic</td><td>Junior</td><td>Theory: https://www.youtube.com/watch?v=Qu5gX2uOaL8</td></tr>
<tr><td colspan="3">7. Data Structure & Algorithm</td><td></td><td>Junior</td><td>Theory: https://algs4.cs.princeton.edu/lectures/
PA:<table><tr><td>Equal Stacks</td><td>Easy</td><td>https://www.hackerrank.com/challenges/equal-stacks/problem</td></tr></table></td></tr>
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			Skill	Level	Resource		
					Balanced Brackets	Medium	https://www.hackerrank.com/challenges/balanced-brackets/problem
					Queue using Two Stacks	Medium	https://www.hackerrank.com/challenges/queue-using-two-stacks/problem
					Simple Text Editor	Medium	https://www.hackerrank.com/challenges/simple-text-editor/problem
					Queries with Fixed Length	Hard	https://www.hackerrank.com/challenges/queries-with-fixed-length/problem
					AND xor OR	Hard	https://www.hackerrank.com/challenges/and-xor-or/problem
					Tree: Top View	Easy	https://www.hackerrank.com/challenges/tree-top-view/problem
					Jesse and Cookies	Easy	https://www.hackerrank.com/challenges/jesse-and-cookies/problem
					Breadth First Search: Shortest Reach	Medium	https://www.hackerrank.com/challenges/bfsshortreach/problem
					Contacts	Medium	https://www.hackerrank.com/challenges/contacts/problem
					Median Updates	Hard	https://www.hackerrank.com/challenges/median/problem
					Find the Running	Hard	https://www.hackerrank.com/challenges/find-the-running-median/problem

			Skill	Level	Resource
					Median
					Edit distance — Hard — https://www.hackerrank.com/contests/cse-830-homework-3/challenges/edit-distance/problem
8. Maths	Calculus		Derivative	**Junior**	Theory: Chapter 1 + Chapter 2 + Chapter 4 https://drive.google.com/file/d/1xtbc1mdlMiZN206Quh0PmQW9jjPpxvfB/view?usp=sharing
			Integral	**Junior**	Theory: Chapter 5 (Require) + Chapter 6 (Optional) https://drive.google.com/file/d/1xtbc1mdlMiZN206Quh0PmQW9jjPpxvfB/view?usp=sharing
	Linear Algebra		Basic Concept	**Junior**	Theory: https://www.youtube.com/playlist?list=PLZHQObOWTQDPD3MizzM2xVFitgF8hE_ab
	Probability and Information Theory		Basic Concept	**Junior**	Theory: Chapter 3 (3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8) deeplearningbook.org
			Probability Distribution	**Junior**	Theory: Chapter 3.9 (3.9.1, 3.9.2, 3.9.3) deeplearningbook.org
			Common Function	**Junior**	Theory: Chapter 3.10 deeplearningbook.org
			Bayesian's Rule	**Junior**	Theory: Chapter 3.11 deeplearningbook.org
			Infomation Theory	**Junior**	Theory: Chapter 3.13 deeplearningbook.org
			Structured Probabilistic Models	**Experience**	Theory: Chapter 3.14 deeplearningbook.org
	Statistics	Basic	Concept + Data Visualization	**Junior**	Theory + Example: https://raw.githubusercontent.com/anubhavpnp/travelbuddy/master/Head%20First%20Statistics%20-%20PDF%20Books.pdf
		Sampling	Basic	**Junior**	Theory: https://www.youtube.com/watch?v=s6ApdTvgvOs
			Gibbs Sampling	**Experience**	Theory: https://www.youtube.com/watch?v=7LB1VHp4tLE&ab_channel=ritvikmath
			Monte Carlo Method	**Experience**	Theory: https://www.youtube.com/watch?v=EaR3C4e600k&ab_channel=ritvikmath
	Optimization		Basic	**Junior**	Theory + Example: https://www.youtube.com/watch?v=lzLgtk-lrW0
			Gradient Base & Gradient Free	**Expert**	Theory: http://papers.neurips.cc/paper/6565-learning-supervised-pagerank-with-gradient-based-and-gradient-free-optimization-methods.pdf
9. ML/DL	Model	Shallow	Treebase model	**Junior**	Theory + Example: https://www.analyticsvidhya.com/blog/201

			Skill	Level	Resource
		Learning			6/04/tree-based-algorithms-complete-tutorial-scratch-in-python/
			Linear model	**Junior**	Theory: ML01→ML06 https://trantheanh.github.io/
			Kernel model	**Experience**	Theory: https://www.youtube.com/watch?v=8NYoQiRANpg
		Deep Learning	Linear Topology	**Junior**	Theory: • https://www.geeksforgeeks.org/vgg-16-cnn-model/ • ML07→ML09 https://trantheanh.github.io/
			Inception	**Experience**	Theory: https://arxiv.org/pdf/1512.00567v3.pdf
			Skip-connection	**Experience**	Theory: https://arxiv.org/pdf/1512.03385v1.pdf
			Autoregressive	**Junior**	Theory: RNN/LSTM/GRU: https://en.wikipedia.org/wiki/Recurrent_neural_network
				Senior	Theory: XL-Net - https://arxiv.org/pdf/1906.08237.pdf
			Autoencoder	**Junior**	Theory: AE - https://www.tensorflow.org/tutorials/generative/autoencoder
				Experience	Theory: VAE - https://www.tensorflow.org/tutorials/generative/cvae
				Senior	Theory: BERT - https://arxiv.org/pdf/1810.04805.pdf
			Graph Neural Network	**Expert**	Theory: https://www.youtube.com/playlist?list=PLoROMvodv4rPLKxIpqhjhPgdQy7imNkDn
	Evaluation		Cross Validation	**Junior**	Theory: https://www.youtube.com/watch?v=e0JcXMzhtdY
			Train/Dev/Test Split & Error Analysis	**Junior**	Theory: https://raw.githubusercontent.com/yennlh/ml-yearning/master/Ng_MLY01_13.pdf
			Metrics	**Experience**	Theory + Example: https://scikit-learn.org/stable/modules/model_evaluation.html
			A/B testing	**Experience**	Theory: https://www.youtube.com/watch?v=CH89jd4haRE
			Multi-arm Bandit	**Experience**	Theory: https://youtu.be/e3L4VocZnnQ
	Serving		Serving with TF	**Experience**	Theory: https://neptune.ai/blog/how-to-serve-machine-learning-models-with-tensorflow-serving-and-docker
			Deployment Strategies	**Senior**	Theory: https://neptune.ai/blog/model-deployment-strategies
	Data Augmentation			**Junior**	Theory: https://www.deeplearningbook.org/contents/regularization.html (Chapter 7.4)

			Skill	Level	Resource
	Learning Realm	Supervise Learning		**Junior**	Theory: https://www.coursera.org/learn/machine-learning?specialization=machine-learning-introduction
		Unsupervise Learning		**Junior**	
		Semi-supervise Learning		**Expert**	Theory: https://arxiv.org/pdf/2103.00550.pdf
		Meta Learning	Transfer Learning	**Experience**	Theory: https://arxiv.org/pdf/1911.02685.pdf
			Multi-task Learning	**Experience**	Theory: deeplearningbook.org (Chapter 7.7)
			Few Shot Learning	**Senior**	Theory: https://arxiv.org/pdf/2205.06743.pdf
			Self-supervise Learning	**Expert**	Theory: https://github.com/jason718/awesome-self-supervised-learning
			Self Training	**Expert**	Theory: https://arxiv.org/pdf/2202.12040.pdf
		Model Compression	• Pruning • Quantization • Distilation	**Senior**	Theory: https://towardsdatascience.com/three-model-compression-methods-you-need-to-know-in-2021-1adee49cc35a
	Model Capacity & Hyperparams Tuning		Learning Rate	**Junior**	Theory: https://towardsdatascience.com/understanding-learning-rates-and-how-it-improves-performance-in-deep-learning-d0d4059c1c10
			Weight Decay	**Junior**	Theory: https://www.deeplearningbook.org/contents/ml.html
			Dropout	**Junior**	Theory + Example: https://trantheanh.github.io/2017/06/26/ML-17/
			Basic	**Experience**	Theory: https://www.deeplearningbook.org/contents/ml.html
			Batch Normalization	**Experience**	Theory: https://arxiv.org/pdf/1502.03167.pdf
	Attacking Model		Model Poisoning	**Expert**	Theory: https://arxiv.org/pdf/2112.02797.pdf
			Model Extraction	**Expert**	Theory: https://www.youtube.com/watch?v=Jxvi9eCDrnQ
			Model Evasion	**Senior**	Theory: https://towardsdatascience.com/evasion-attacks-on-machine-learning-or-adversarial-examples-12f2283e06a1
	Monitoring		Model Visualization	**Senior**	Theory: https://neptune.ai/blog/visualizing-machine-learning-models
			Data/Concept Drift	**Senior**	Theory: https://neptune.ai/blog/ml-model-monitoring-best-tools

		Skill	Level	Resource
		Performance	**Senior**	Theory: https://neptune.ai/blog/ml-model-monitoring-best-tools
10. Other	Docker	Concept	**Experience**	Theory: https://www.youtube.com/watch?v=rOTqprHv1YE
		Practice	**Experience**	Theory: https://www.youtube.com/playlist?list=PL6gx4Cwl9DGBkvpSIgwchk0glHLz7CQ-7
	Linux		**Junior**	Theory + Quizz: Theo chương trình học chung
	Git		**Junior**	Theory: https://www.coursera.org/learn/introduction-git-github
	Ansible		**Experience**	Theory: https://www.tutorialspoint.com/ansible/index.htm

2 B. Certificate:

Course Name	Level	Estimate Time (days)	Resource	Parent Course
Introduction to Big Data with Spark & Hadoop	**Junior**	03	https://www.coursera.org/learn/introduction-to-big-data-with-spark-hadoop	N/A
Big Data Introduction	**Junior**	04	https://www.coursera.org/learn/big-data-introduction?specialization=big-data	https://www.coursera.org/specializations/big-data
Big Data Management	**Experience**	03	https://www.coursera.org/learn/big-data-management?specialization=big-data	https://www.coursera.org/specializations/big-data
Big Data Integration & Processing	**Senior**	05	https://www.coursera.org/learn/big-data-integration-processing?specialization=big-data	https://www.coursera.org/specializations/big-data
Big Data Graph Analytics	**Senior**	05	https://www.coursera.org/learn/big-data-graph-analytics?specialization=big-data	https://www.coursera.org/specializations/big-data
Machine Learning Introduction	**Junior**	07	https://www.coursera.org/learn/machine-learning?specialization=machine-learning-introduction	https://www.coursera.org/specializations/machine-learning-introduction
Introduction Git & Github	**Junior**	03	https://www.coursera.org/learn/introduction-git-github	N/A
Machine Learning Engineering for Production	**Senior**	30	https://www.coursera.org/specializations/machine-learning-engineering-for-production-mlops	N/A
Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization	**Junior**	05	https://www.coursera.org/learn/deep-neural-network?specialization=deep-learning	https://www.coursera.org/specializations/deep-learning

Course Name	Level	Estimate Time (days)	Resource	Parent Course
Structuring Machine Learning Project	**Experience**	02	https://www.coursera.org/learn/machine-learning-projects?specialization=deep-learning	https://www.coursera.org/specializations/deep-learning

3 C. Courses:

Course Name	Resource
CS329S - ML System	https://www.youtube.com/playlist?list=PLSrTvUm384I9PV10koj_cqit9OfbJXEkq
CS224n - NLP	https://www.youtube.com/playlist?list=PLoROMvodv4rOSH4v6133s9LFPRHjEmbmJ
CS224w - Machine Learning with Graphs	https://www.youtube.com/playlist?list=PLoROMvodv4rPLKxIpqhjhPgdQy7imNkDn
CS229 - Machine Learning	https://www.youtube.com/playlist?list=PLoROMvodv4rNH7qL6-efu_q2_bPuy0adh
CS231n - Convolutional Neural Network for Visual Recognition	https://www.youtube.com/playlist?list=PLC1qU-LWwrF64f4QKQT-Vg5Wr4qEE1Zxk
CS230 - Deep Learning	https://www.youtube.com/playlist?list=PLoROMvodv4rOABXSygHTsbvUz4G_YQhOb
CMU's Multimodal Machine Learning	https://www.youtube.com/playlist?list=PL-Fhd_vrvisNup9YQs_TdLW7DQz-lda0G
Deep Mind - Introduction to Reinforcement Learning	https://www.youtube.com/playlist?list=PLqYmG7hTraZDM-OYHWgPebj2MfCFzFObQ
MIT 9.520 - Statistical Learning Theory & Applications	https://www.youtube.com/playlist?list=PLyGKBDfnk-iDj3FBd0Avr_dLbrU8VG73O
Harvard Stat 110 - Probability	https://www.youtube.com/playlist?list=PL2SOU6wwxB0uwwH80KTQ6ht66KWxbzTIo

4 Knowledge & Level mapping

1. Kiến thức về **Programming Language (Python)**:
    - Data & Collection types (**Junior**)
    - Variable Scope & Binding (**Junior**)
    - Logic Control (**Junior**)
    - Package, Module & Function (**Junior**)
    - Magic Method **(Junior)**
    - Garbage Collector **(Experience)**
    - Data Serialization **(Experience)**
    - Process & Thread **(Experience)**
    - Functional Programming **(Senior)**
    - Object-Orientated Programming **(Senior)**
    - Meta Programming **(Senior)**
2. Kiến thức về **Design**:
    - Design Pattern
        - Factory Pattern **(Junior)**
        - Singleton Pattern **(Junior)**
        - Template Pattern **(Junior)**
        - Observer Pattern **(Experience)**
        - Strategy Pattern **(Senior)**
        - Proxy Pattern **(Senior)**
        - Adapter Pattern **(Senior)**
    - API Design **(Senior)**
    - System Service Design **(Senior)**
    - Model Learning Design **(Expert)**
3. Kiến thức về **Data Structure & Algorithm**:
    - Basic Data Structure **(Junior)**
        - Stack
        - Queue
        - List
        - Tree
    - Recursive **(Junior)**
    - Combination **(Junior)**
    - Sorting **(Junior)**
    - Searching **(Experience)**
    - Dynamic Programming **(Senior)**
    - Graph **(Senior)**
        - Graph Representation

- Graph Search

4. Kiến thức về **Database**:
    a. SQL: **(Junior)**
    b. NoSQL: **(Experience)**
        - MongoDB
        - Elastic Search
        - Click House
5. Kiến thức về **Visualization**:
    a. Basic:
        - Scatterplot **(Junior)**
        - Histogram **(Junior)**
        - Bar Chart **(Junior)**
        - Pie Chart **(Junior)**
        - Countplot **(Junior)**
        - Boxplot **(Experience)**
        - Heatmap **(Experience)**
        - Distplot **(Experience)**
        - Jointplot **(Experience)**
    b. Dimensionality Reduction
        - PCA **(Experience)**
        - tSNE **(Experience)**
6. Kiến thức về **Mathematic**:
    a. Calculus:
        - Derivative **(Junior)**
        - Integral **(Junior)**
    b. Linear Algebra:
        - Vector/Matrix/Tensor **(Junior)**
        - Transformation **(Junior)**
        - Basis **(Junior)**
        - Eigen Vectors/Values **(Experience)**
    c. Probability & Information Theory:
        i. Random Variable & Random Process **(Junior)**
        ii. Probability Distribution **(Junior)**
        iii. Bayesian Rule **(Junior)**
        iv. Information Theory **(Experience)**
        v. Probabilistic Graphical Model **(Senior)**
    d. Statistics:
        - Mean, Std, Variance, Median, ... **(Junior)**
        - Sampling **(Experience)**
        - Hypothesis Tests **(Senior)**

e. Optimization:
   - Optimizing with Derivative **(Junior)**
   - Gradient Base & Gradient Free **(Senior)**

7. Kiến thức về **Machine Learning**:
   a. Shallow Learning
      - Linear Model **(Junior)**
      - Treebase Model **(Junior)**
      - Kernel Method **(Experience)**
      - Essemble Model **(Experience)**
        - Bagging
        - Boosting
        - Stacking

   b. Deep Learning
      i. Model Topology **(Experience)**
      ii. Inception **(Experience)**
      iii. Skip-connection **(Experience)**
      iv. Attention **(Senior)**
      v. Autoregressive **(Senior)**
      vi. Autoencoder **(Senior)**
      vii. Deep Graph Neural Network **(Expert)**
      viii. Deep Bayesian Neural Network **(Expert)**

   c. Meta Learning
      - Transfer Learning **(Experience)**
      - Multi-task Learning **(Experience)**
      - One/Few Shot Learning **(Senior)**
      - Self-Supervise Learning **(Expert)**
      - Self Training **(Expert)**
      - Semi-Supervise Learning **(Expert)**

   d. Hyper-parameter Tuning
      - Grid Search **(Experience)**
      - Random Search **(Experience)**
      - Hyperband **(Senior)**

   e. Evaluation & Error Analysis
      - Train/Dev/Test Validation **(Junior)**
      - K-fold Validation **(Experience)**
      - Distribution Mismatch **(Experience)**
      - Eyeball/Blackbox Validation **(Senior)**

   f. Regularization
      - Weight Decay **(Junior)**
      - Dropout **(Junior)**

- Data Augmentation **(Experience)**
- Batch Normalization **(Experience)**

g. Model Compression:
- Pruning **(Senior)**
- Quantization **(Senior)**
- Distilation **(Senior)**

h. Model Attacking:
- Model Poisoning **(Expert)**
- Model Extraction **(Expert)**
- Model Evasion **(Senior)**

8. Kiến thức về **MLOps**:
   - Data Gathering **(Junior)**
   - Data Analysis **(Experience)**
   - Data Transformation/Preparation **(Experience)**
   - Model Training/Development **(Junior)**
   - Model Serving **(Experience)**
   - Model Monitoring **(Experience)**
   - Model Re-training **(Senior)**
   - Model Evaluation **(Junior)**
   - Model Validation **(Senior)**
   - ML Pipeline Orchestration **(Senior)**
   - CI/CD/CT **(Senior)**
   - Model Management **(Experience)**
   - ML Metadata Management **(Senior)**
   - Feature Management **(Experience)**
9. Kiến thức về **Big Data**:
   a. Spark & Hadoop **(Junior)**
   b. Management **(Experience)**
   c. Integration & Processing **(Experience)**
   d. Analytics **(Experience)**
   e. Message Queue: **(Experience)**
      i. Kafka
      ii. Redis
10. Kiến thức về **Computing**:
    a. Distributed Training
       i. Mirror Strategy **(Experience)**
       ii. Multi-worker Mirror Strategy **(Experience)**
       iii. Parameter Server **(Senior)**
    b. MapReduce **(Senior)**
11. Kiến thức về **Analysis**:

- Regression Analysis **(Junior)**
- Monte Carlo Simulation **(Experience)**
- Factor Analysis **(Experience)**
- Cohort Analysis **(Experience)**
- Cluster Analysis **(Experience)**
- Time series Analysis **(Experience)**

12. Kiến thức về **Versioning**:
    a. Code Versioning (Git) **(Experience)**
    b. Data Versioning **(Senior)**
    c. Feature Versioning (Feature Store) **(Senior)**
13. Kiến thức về **Containerization**:
    a. Docker **(Experience)**
    b. Docker-compose **(Experience)**
    c. Kubernetes **(Senior)**
    d. Kubeflow **(Senior)**