



FINAL PORTFOLIO— ITAI 2376

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GitHub: https://github.com/JudithBarrios/ITAI2376_Portfolio_JudithBarrios.git

Course Overview

- Explored core AI concepts including Neural Networks, NLP, Transformers, VAEs, GANs, and Agents
- Project-Based learning reinforced with real world applications and creative assignments
- Hands on work with deep learning models and GitHub portfolio development



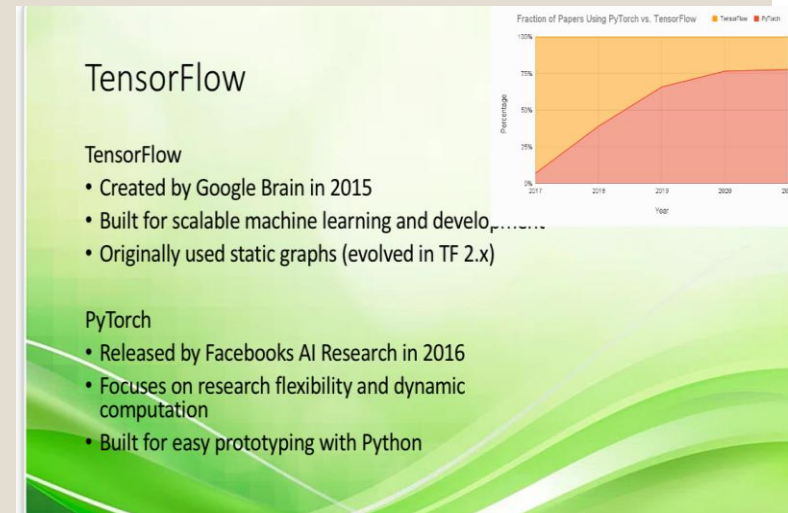
A02 – Framework Comparison

- Compared TensorFlow and PyTorch
- Assessed usability, documentation, and performance
- Learned how framework choice impacts AI development
- Gained experience navigating different APIs and community ecosystems

Key Resource Highlights:

- ITAI2376_L02.ipynb – hands on setup using both frameworks
- Daniel Bourkes Code-First TensorFlow – showed practical model implementation -
https://www.youtube.com/watch?v=tpCFfeUEGs8&utm_source=chatgpt.com

Relevance: Helped build foundational knowledge of tools before modeling



A03 – Neural Network Zoo

- Explored different architectures: CNN, RNN, GAN, etc.
- Submitted creative infographic visualizing network types
- Gained deeper understanding of model capabilities
- Recognized how architecture choice relates with specific AI tasks

Key Resource Highlights:

- Neural Network Basics.pptx – explained architecture functions - <https://www.ibm.com/think/topics/neural-networks>
- Media Gallery support videos – animated network flows - <https://www.youtube.com/watch?v=JRwTCKjc37o>

Relevance: Strengthened ability to map models to real world problems



A04 – Teaching Deep Learning to an 11-Year-Old

- Explained CNNs using simple visuals and metaphors
- Improved communication and presentation skills
- Highlighted ability to translate technical concepts
- Developed analogies to explain filters, layers, and feature extraction

Key Resources:

- NIPS 2012 AlexNet Paper- foundation of modern CNNs - <https://proceedings.neurips.cc/paper/4824-imagenet-classification-with-deep-convolutional-neural-networks.pdf>
- “An image is worth 16x16 Words” – Simplified transformer vision - <https://arxiv.org/abs/2010.11929>

Relevance: Improved ability to teach, explain and simplify deep learning

Recap for Kids (Interactive for Kids)

What happens if Abby skips steps?



A! She gets to the answer taster

X She might fall or get lost 🤔

Correct answer: **B!**

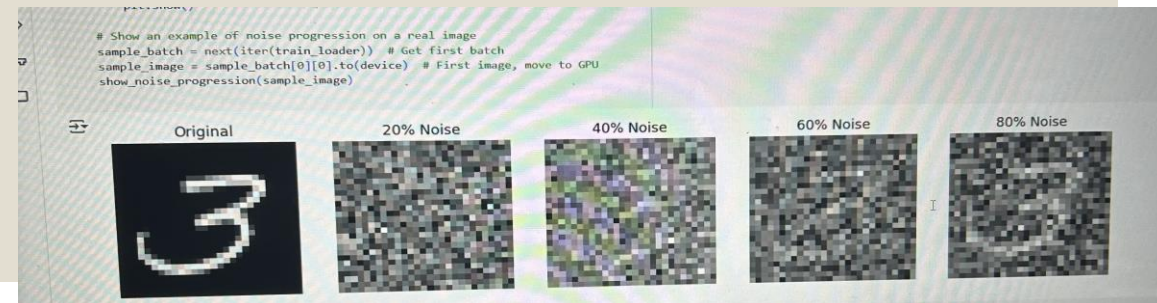
MidTerm – CIFAR-10 Diffusion Model

- Implemented U-Net based diffusion model
- Generated synthetic images and evaluated quality
- Included training results and image samples
- Tuned hyper parameters to balance training time and output quality

Key Resources:

- “Denoising Diffusion Probabilistic models” - Model architecture guide-
https://arxiv.org/abs/2006.11239?utm_source=chatgpt.com
- “Diffusion for image segmentation”– explained conditional outputs -
<https://medium.com/@myschang/diffusion-models-for-image-to-image-and-segmentation-d30468114b27>

Relevance: Hands-on experience with generative modeling and evaluation



A05 – NLP and Arrival

- Analyzed film themes through AI concepts
- Connected RNNs and sequence modeling to communication barriers
- Reflected on the importance of language and intent in AI
- Explored emotional nuance and context in language modeling

Key Resources:

- “What BERT is Not”- Clarified model limitations - https://arxiv.org/abs/1907.13528?utm_source=chatgpt.com
- “VisualWord2Vec”- Grounded language in visual cues - <http://satwikkottur.github.io/VisualWord2Vec/>

Relevance: Deepened understanding of communication in AI systems



INTRODUCTION AND MOVIE SUMMARY

ARRIVAL IS ABOUT ALIENS LANDING ON EARTH AND HUMANS TRYING TO COMMUNICATE WITH THEM, LINGUIST LOUISE BANKS IS ASKED TO FIGURE OUT THEIR LANGUAGE.

THE MOVIE SHOWS HOW LANGUAGE AND UNDERSTANDING ARE DEEPLY CONNECTED, WHICH IS ALSO A KEY TOPIC IN NLP.



NLP CHALLENGES SHOWN IN THE MOVIE

- **AMBIGUITY: "OFFER WEAPON" – IS A THREAT OR A GIFT?**
- **IDIOMS AND CULTURE: ALIENS DON'T GET HUMAN EXPRESSIONS**
- **SARCASM AND TONE: EMOTIONAL MEANING IS HARD TO DETECT**
- **TIME AND GRAMMAR: ALIEN LANGUAGE IS NOT LINEAR**
- **NO TRAINING DATA: LOUISE STARTS WITH NOTHING**



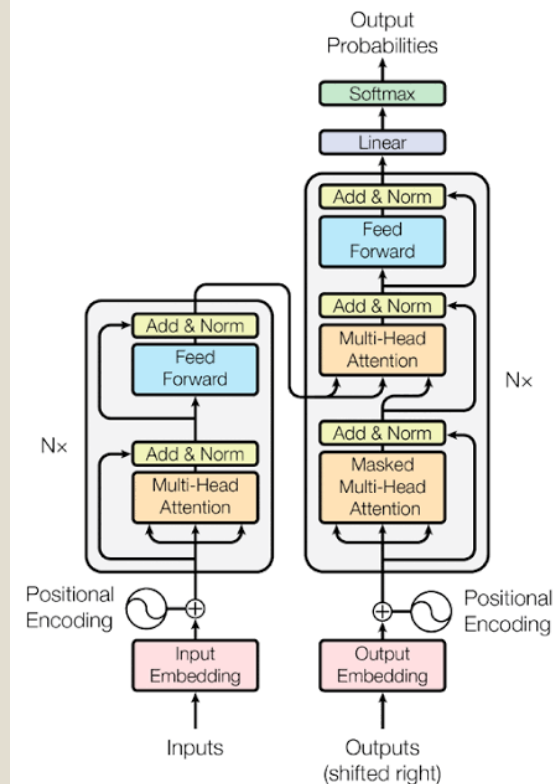
Advanced Topics – Transformers, VAEs, GANs

- Studied attention mechanisms and transformer models
- Learned how VAEs encode latent space for generative tasks
- Reviewed GANs adversarial training for realism
- Practiced explaining model trade-offs between creativity and control

Key Resources:

- “What is a Transformer?” (NVIDIA)- Simplified attention logic - <https://blogs.nvidia.com/blog/what-is-a-transformer-model/#:~:text=A%20transformer%20model%20is%20a,the%20words%20in%20this%20sentence.>
- “GANs (medium.com)- illustrated training challenges and realism - <https://jonathan-hui.medium.com/gan-whats-generative-adversarial-networks-and-its-application-f39ed278ef09>

Relevance: Connected model choices with creative, generative applications



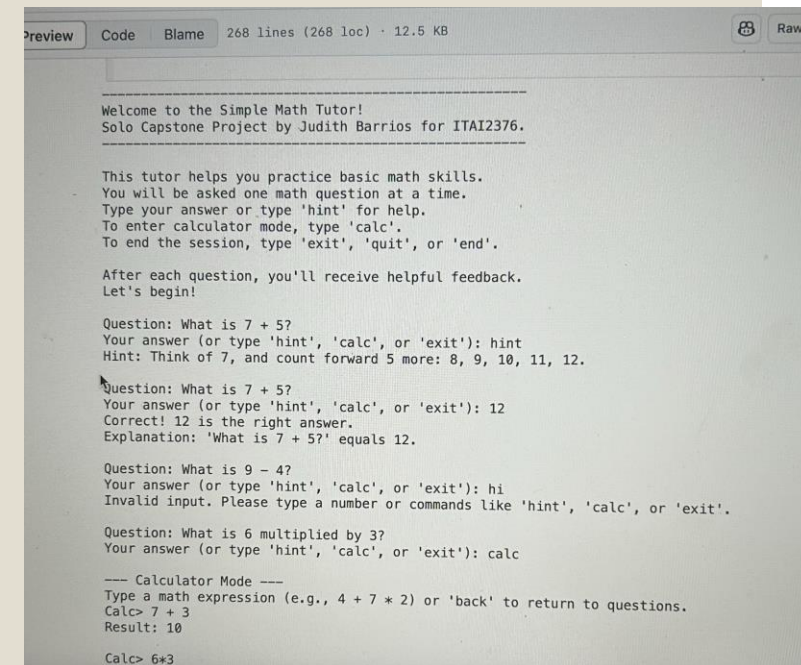
Capstone Foundations –AI Agents and Reasoning

- Modules 10-14 focused on AI agents, planning, and RAG
- Reviewed Lang chain, AutoGen, and multi agent orchestration
- Prepared foundational knowledge for Capstone AI Agent system
- Identified real world uses cases for agents in automation and decision making

Key Resources:

- “LLM-Based Agents Guide”- Explained agent structure - <https://www.superannotate.com/blog/llm-agents#:~:text=LLM%20agents%20generally%20consist%20of%20four%20components%3A%20the%20agent%20or,ongoing%20discussions%20and%20long%2Dterm>
- “Mastering RAG Architecture” - Enabled reliable multi step reasoning - <https://www.signitysolutions.com/blog/mastering-rag-implementation>

Relevance: Equipped you to build intelligent, autonomous AI systems



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Preview Code Blame 268 lines (268 loc) · 12.5 KB

Welcome to the Simple Math Tutor!
Solo Capstone Project by Judith Barrios for ITAI2376.

This tutor helps you practice basic math skills.
You will be asked one math question at a time.
Type your answer or type 'hint' for help.
To enter calculator mode, type 'calc'.
To end the session, type 'exit', 'quit', or 'end'.

After each question, you'll receive helpful feedback.
Let's begin!

Question: What is 7 + 5?
Your answer (or type 'hint', 'calc', or 'exit'): hint
Hint: Think of 7, and count forward 5 more: 8, 9, 10, 11, 12.

Question: What is 7 + 5?
Your answer (or type 'hint', 'calc', or 'exit'): 12
Correct! 12 is the right answer.
Explanation: 'What is 7 + 5?' equals 12.

Question: What is 9 - 4?
Your answer (or type 'hint', 'calc', or 'exit'): hi
Invalid input. Please type a number or commands like 'hint', 'calc', or 'exit'.

Question: What is 6 multiplied by 3?
Your answer (or type 'hint', 'calc', or 'exit'): calc

--- Calculator Mode ---
Type a math expression (e.g., 4 + 7 * 2) or 'back' to return to questions.
Calc> 7 + 3
Result: 10

Calc> 6*3
```

Final Reflections and GitHub

- Strengthened skills in AI theory and hands on modeling
- Improved project presentation and GitHub Organization
- Build confidence interpreting code, models, and documentation into a polished portfolio
- GitHub Repository: https://github.com/JudithBarrios/ITAI2376_Portfolio_JudithBarrios.git

Work Cited

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- Sharma, Ashwani. "Mastering Rag Implementation: Covering All the Basics." *We Help in The Digital Transformation of Businesses*, Signity Software Solutions Pvt Ltd, 23 Apr. 2025, www.signitysolutions.com/blog/mastering-rag-implementation.