

About Me

- AI/ML Engineer at Lockheed Martin
- IEEE
 - Region 1 Young Professionals Coordinator (Chair)
 - Syracuse Section Treasurer
- Publications with IEEE and MSS on:
 - Deep Learning applications in Signal Processing
 - Radar, Audio, and Image Signal Processing
 - Radar Systems
 - Autonomous Vehicles
 - Large Language Models
- B.S. Electrical Engineering, Binghamton University



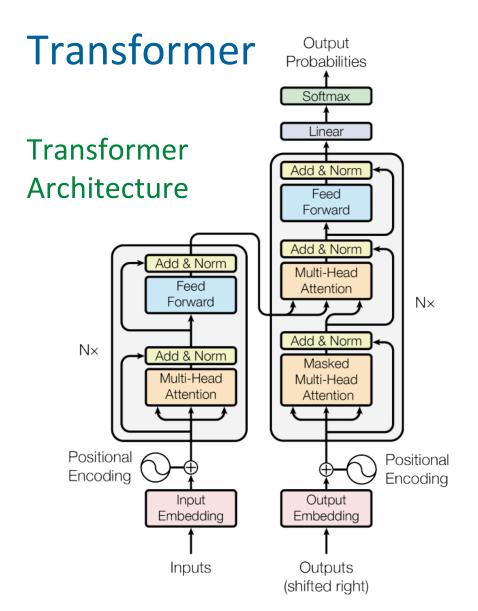


Contents

- LLM / Transformer overview
- How I got AI to control my 80lb robot
- Letting AI control my 80lb robot



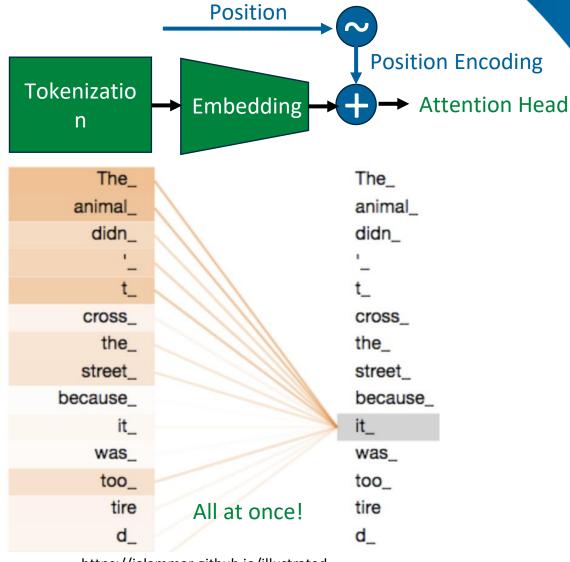




[2] A. Vaswani et al., "Attention is All You Need,"



Self Attention



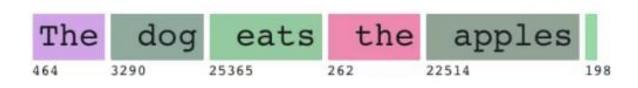
https://jalammar.github.io/illustrated-transformer/

Transformers enable massive



Tokenization

- Machine Learning is a lot of math
 - Poetry, while equally beautiful, is not directly math
- Tokenizer formats text into numbers for math
- "Context Length" -> Number of tokens







https://simonwillison.net/2023/Jun/8/gpt-tokenizers/

What is the squart root of dog?

$$\sqrt{dog}$$
=??

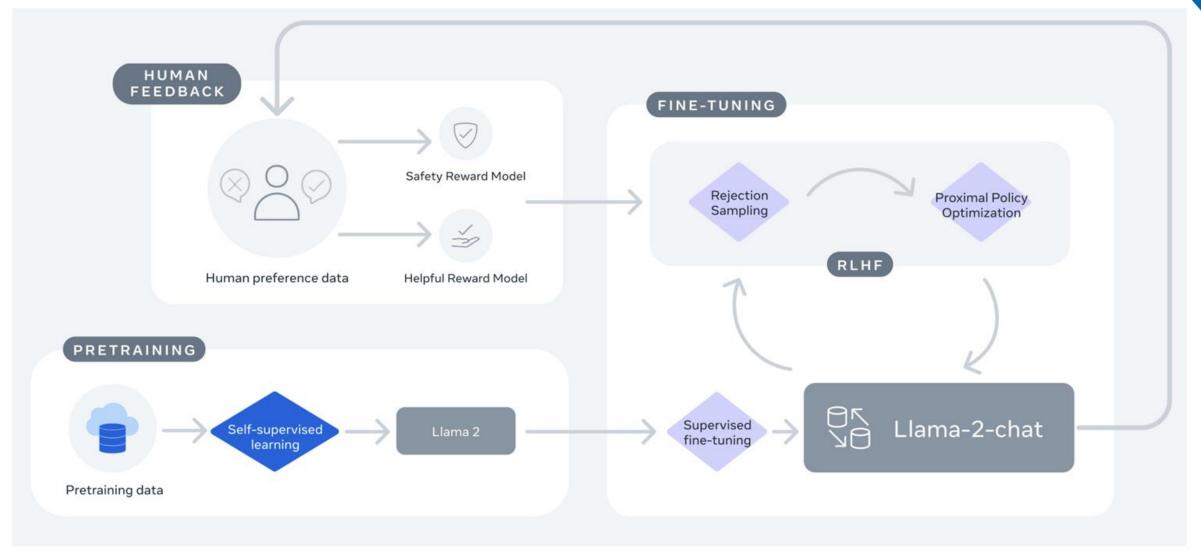
Tokenize!

$$\sqrt{dog} = \sqrt{Tokenize(dog)}$$
$$= \sqrt{3290} \approx 57.3$$





Model Training







Finetuning

Model can be tuned to a task

Traditional Fine-tuning

- Repeated gradient updates





Implicit few-shot learning - No gradient updates

One-shot

In addition to the task description, the model sees a single example of the task. No gradient updates are performed.

```
Translate English to French: ← task description

sea otter => loutre de mer ← example

cheese => ← prompt
```

Few-shot

In addition to the task description, the model sees a few examples of the task. No gradient updates are performed.

```
Translate English to French: 

sea otter => loutre de mer 

peppermint => menthe poivrée

plush girafe => girafe peluche

cheese => 

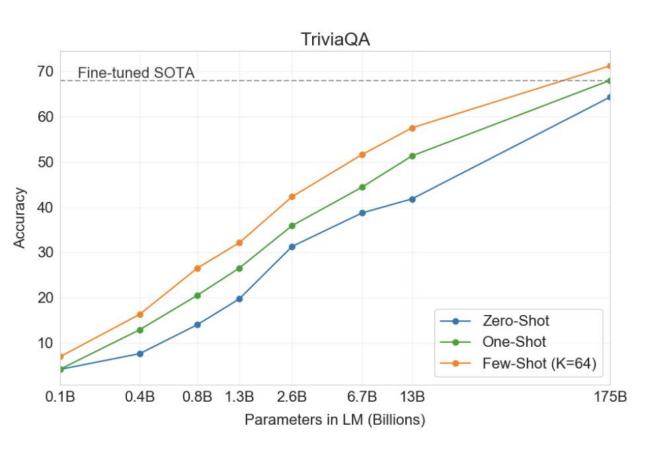
prompt
```

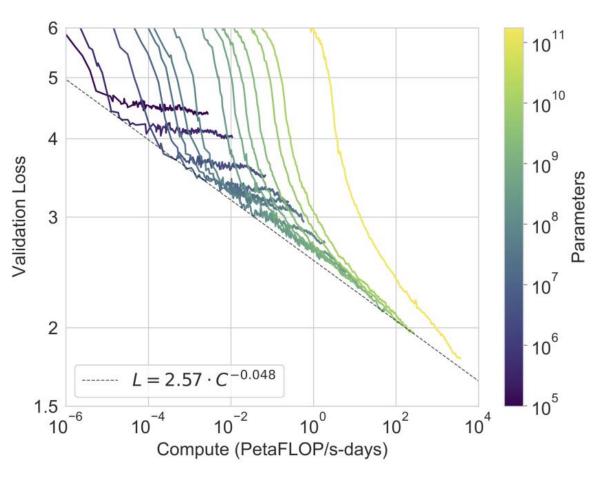


[5] T. Brown et al., "Language Models are Few-Shot Learners"

Model Size and Performance

Model performance (generally) scales with model size and training compute



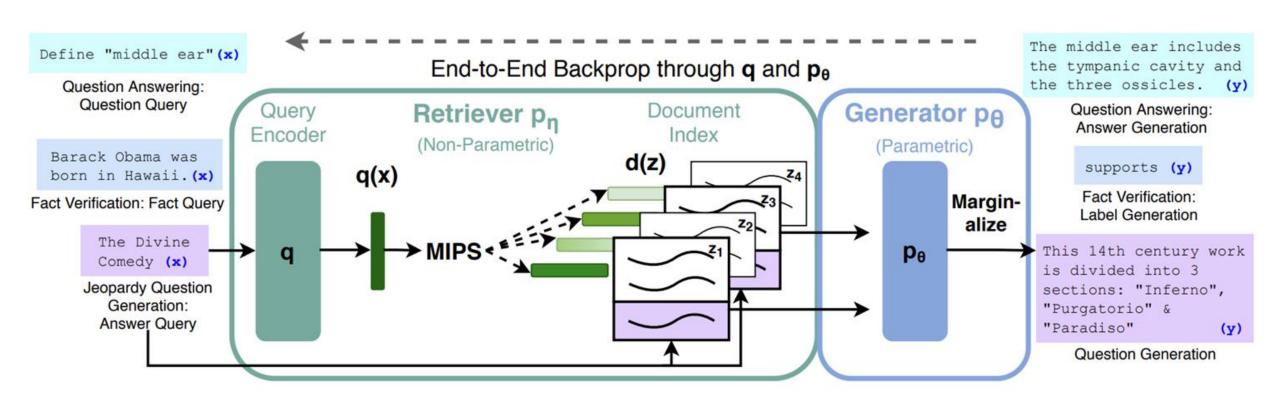






RAG – Retrieval Augmented Generation

- Embedding search for relevant documents
- Relevant documents appended with query as context





[6] P. Lewis et al., "Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks,"

References

Seq2Seq [1] I. Sutskever, O. Vinyals, and Q. V. Le, "Sequence to Sequence Learning with Neural Networks," *Proc. Advances in Neural Information Processing Systems 27 (NeurIPS 2014)*, Montreal, Canada, Dec. 2014. [Online]. Available: https://arxiv.org/abs/1409.3215.

Transformer [2] A. Vaswani et al., "Attention is All You Need," *Proc. 31st Conf. Neural Information Processing Systems (NeurIPS 2017)*, Long Beach, CA, USA, Dec. 2017. Available: https://github.com/tensorflow/tensor2tensor.

GPT 1 [3] A. Radford et al., "Improving Language Understanding by Generative Pre-Training," OpenAI, 2018, Preprint. Available: https://openai.com.

GPT 2 [4] A. Radford et al., "Language Models are Unsupervised Multitask Learners," OpenAI, 2019, Preprint. Available: https://cdn.openai.com/better-language-models/language-models-are-unsupervised-multitask-learners.pdf.

GPT 3 [5] T. Brown et al., "Language Models are Few-Shot Learners," *Proc. Advances in Neural Information Processing Systems 33 (NeurIPS 2020)*, Dec. 2020. Available: https://arxiv.org/abs/2005.14165.

RAG [6] P. Lewis et al., "Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks," *Proc. Advances in Neural Information Processing Systems 33 (NeurIPS 2020)*, Dec. 2020. [Online]. Available: https://arxiv.org/abs/2005.11401

InstructGPT [7] S. Bai et al., "Training Language Models to Follow Instructions with Human Feedback," OpenAI, 2022, Preprint. Available: https://arxiv.org/abs/2203.02155.

Llama 2 [8] H. Touvron et al., "Llama 2: Open Foundation and Fine-Tuned Chat Models," Meta AI, 2023. [Online]. Available: https://arxiv.org/abs/2307.09288.

Whisper [9] C. Weng et al., "Robust Speech Recognition via Large-Scale Weak Supervision," *Proc. Advances in Neural Information Processing Systems 34 (NeurIPS 2021)*, Dec. 2021. Available: https://arxiv.org/abs/2110.03174.





Letting GenAl Control my Robot

Setup:

- Python program on Mac (which Gemini wrote)
- iPhone camera via Continuity
- USB Serial connection to Scorbot ER VII
- Google Gemini 1.5 Pro API

Process

- Initialize model with Scorbot ACL manual
- Connect to Robot, Camera, Gemini
- Instructions via natural language
- Gemini has direct control over the robot and camera
- Interactive instruction process







Demo

Read "my" code:

https://github.com/sciencesam/gemini_scorbot_controller







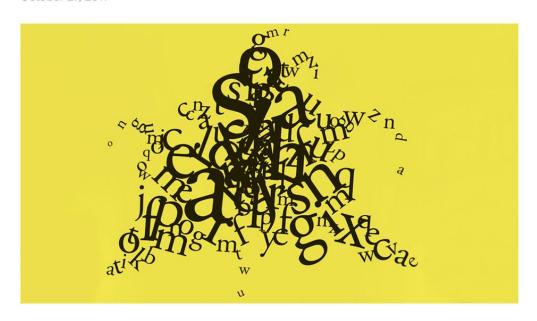
Use LLMs to Summarize an Article

Giving Feedback

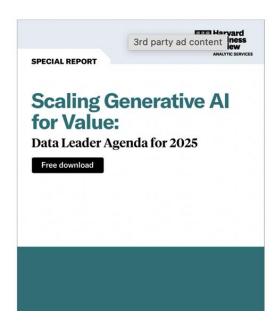
How to Give Feedback People Can Actually Use

by Jennifer Porter

October 27, 2017







https://hbr.org/2017/10/how-to-give-feedback-people-can-actually-use





Human Summary

- Big-picture focused.
- Organizationally aligned.
- Behavioral and specific.
- Factual, not interpretive.
- Both positive and negative.
- Focused on patterns.
- Linked to impact.
- Prioritized.





First Pass

ChatGPT ~





Can you summarize the key points on how to form good feedback from this article? The article, *How to Give Feedback People Can Actually Use* by Jennifer Porter, emphasizes creating strategic, developmental feedback that is actionable and insightful. Key points include:

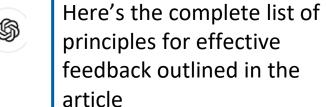
- **1.Big-Picture Focus**: Feedback should identify what the individual should do more or less of to align with organizational goals and maximize effectiveness.
- **2.Organizational Alignment**: Effective feedback reflects the values and competency models of the organization rather than personal preferences.
- **3.Behavioral Specificity**: Focus on specific actions rather than vague descriptors. For instance, instead of calling someone "inspiring," explain what actions led to that impression.
- **4.Factual and Non-Interpretive**: Avoid subjective judgments. Base feedback on observable actions rather than interpretations of behavior.
- **5.Balanced (Positive and Negative)**: Highlight both strengths and areas for improvement to encourage growth and engagement.
- **6.Pattern-Based**: Address recurring behaviors rather than isolated incidents to provide a clearer picture of habits or

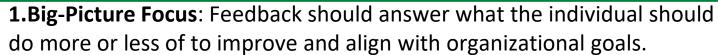




Second Pass

Is that all?





- **2.Organizational Alignment**: Ground feedback in the organization's leadership values or competency models, avoiding personal biases.
- **3.Behavioral and Specific**: Use precise, actionable observations rather than vague labels or broad terms.
- **4.Factual, Not Interpretive**: Describe what you observe rather than interpreting motives or emotions, which may not be accurate.
- **5.Balanced (Positive and Negative)**: Include what the individual is doing well and areas for improvement to drive growth while boosting engagement and innovation.
- **6.Focused on Patterns**: Highlight recurring behaviors instead of single instances to provide meaningful insights.
- **7.Linked to Impact**: Explain how the individual's behavior affects others or the organization, emphasizing the real-world consequences of their actions.
- **8.Prioritized**: Limit feedback to a few critical areas at a time to avoid overwhelming the individual and to enable focused improvement.
- **9.Supported by Examples**: Use real-life situations to illustrate patterns and link them to broader implications for better clarity.

These principles aim to make feedback a tool for development rather than criticism, ensuring it is constructive and promotes meaningful change.







Use GenAI to help draft an email



How can Claude help you today?

Claude Haiku R. Choose style v





Can you help revise this email for clarity. I am hoping to accomplish two things:

1

- Inform IEEE Syracuse volunteers about the training and get them to spread the word to prospective volunteer leaders
- Ask for the Syracuse Section Chair, Tim, to hold a vote on \$1k to sponsor three volunteers to attend

For context, here is a agenda for the training:

How does OU Analytics work? What actually is IEEE Young Professionals? Why didn't anyone get my eNotice? Can GenAI help me respond to this email? In preparation for the merger with Region 2, Region 1 is organizing hybrid IEEE leadership training sessions to answer these questions and more at Buffalo State University on December 7th from 9:30 am until 4pm with dinner to follow.

Claude Haiku R Choose style v

Claude cannot access links





* Good afternoon, Sam

Subject: Represent Syracuse - IEEE Region 1 Training in Buffalo 12/7 Body:

1

Hello,

The IEEE Region 1 training team is holding an **hybrid IEEE training** session in **Buffalo** next weekend, **December 7th**, 2024, from ~ 9am to 4pm. Topics include Generative AI, Sections and Chapters, <u>OUAnalytics/vTools</u>, IEEE Students, Finance, and more; full agenda in vTools.

This is a great opportunity:

- to learn more about your current (or next) IEEE role
- to network with IEEE leaders from around Regions 1 and 2 (virtually or over free food and drinks)

Nearby sections (Buffalo, Rochester, Binghamton, etc) are sending 2-5 volunteers each, so I'd like Syracuse to do the same. With Region 1/MGA/Buffalo Section covering the cost of the training, @Tim Horan could the Section cover lodging for three volunteers to attend, say NTE \$1k?

Claude Haiku R. Choose style v

Claude cannot access links







Al "Improved"

Al Notes

Subject: Syracuse IEEE Members: Leadership Training Opportunity in Buffalo - December 7th

Hello IEEE Syracuse Volunteers,

The IEEE Region 1 training team is hosting a hybrid leadership training session on **December 7th**, 2024, from 9:30 AM to 4 PM at Buffalo State University. This is a unique opportunity for our section to engage and develop future leaders.

Training Highlights:

- Comprehensive overview of IEEE operations
- Sessions on Young Professionals, Sections and Chapters
- Insights into OUAnalytics, vTools, and Generative AI
- Networking with IEEE leaders from Regions 1 and 2
- Free full-day training with lunch and dinner provided

Why Attend:

- Gain deeper understanding of IEEE's structure and opportunities
- Connect with leaders from nearby sections
- Develop leadership skills at no personal cost

Buffalo, Rochester, and Binghamton sections are each sending 2-5 volunteers. We want Syracuse to have strong representation!

Request to Section Chair:

Tim, I propose we sponsor three volunteers' lodging expenses, not to exceed \$1,000. This would enable our members to benefit from this valuable training opportunity.

If you know potential volunteers interested in IEEE leadership, please forward this invitation.

Training Details:

- Date: December 7th, 2024
- Time: 9:30 AM 4 PM
- Location: Buffalo State University
- Registration: https://events.vtools.ieee.org/m/447355

Full agenda available in vTools.

I'll help you revise the email for clarity and effectiveness. Here's an improved version:

The revised email:

- Clarifies the purpose and value of the training
- Highlights key session topics
- Makes a clear request for Tim to consider sponsorship
- Provides all necessary details
- Maintains a professional and enthusiastic tone
- Includes a call to action for forwarding the invitation

Would you like me to make any further adjustments?

Original

Subject: Represent Syracuse - IEEE Region 1 Training in Buffalo 12/7

Hello,

The IEEE Region 1 training team is holding an **hybrid IEEE training** session in **Buffalo** next weekend, **December 7th**, 2024, from ~ 9am to 4pm. Topics include Generative AI, Sections and Chapters, OUAnalytics/vTools, IEEE Students, Finance, and more; full agenda in <u>vTools</u>.

This is a great opportunity:

- to learn more about your current (or next) IEEE role

Nearby sections (Buffalo, Rochester, Binghamton, etc) are sending 2-5 volunteers each, so I'd like Syracuse to do the same. With Region 1/MGA/Buffalo Section covering the cost of the training, <u>@Tim Horan</u> could the Section cover lodging for three volunteers to attend, say NTE \$1k?

If you know anyone within your Chapter who would be interested, feel free to forward.

vTools link: https://events.vtools.ieee.org/m/447355





Changed
Start-Time
(but not end)

Who said it was comprehensive?

Nice overview of "Why"

Removed mention of next IEEE role

Does this need saying?

Subject: Syracuse IEEE Members: Leadership Training Opportunity in Buffalo - December 7th

Hello IEEE Syracuse Volunteers,

Removed Bold

Buffalo -> Buff. State

To the point!

The IEEE Region 1 training team is hosting a hybrid leadership training session on **December 7th**, 2024, from 9:30 AM to 4 PM at Buffalo State University. This is a unique opportunity for our section to engage and develop future leaders.

Training Highlights:

- Comprehensive overview of IEEE operations

- Sessions on Young Professionals, Sections and Chapters
- Insights into OUAnalytics, vTools, and Generative AI
- Networking with IEEE leaders from Regions 1 and 2
- Free full-day training with lunch and dinner provided

Swapped Students for Young Professionals

Why Attend:

- Gain deeper understanding of IEEE's structure and opportunities
- Connect with leaders from nearby sections
- Develop leadership skills at no personal cost

Buffalo, Rochester, and Binghamton sections are each sending 2-5 volunteers. We want Syracuse to have strong representation!

Request to Section Chair:

Tim, I propose we sponsor three volunteers' lodging expenses, not to exceed \$1,000. This would enable our members to benefit from this valuable training opportunity.

If you know potential volunteers interested in IEEE leadership, please forward this invitation.

and online?

Training Details:

- Date: December 7th, 2024
- Time: 9:30 AM 4 PM
- Location: Buffalo State University
- Registration: https://events.vtools.ieee.org/m/447355

Full agenda available in vTools.

More clear? Too long?

Too formal? Where's my voice?

Changed
Start-Time
(but not end)

Buffalo -> Buff. State

Constructive feedback:

Nice overview of "Why"

Could you revise the email. I have some feedback:

I liked how the email was more direct about the benefits of the training to volunteers such as when it asks if people know potential volunteers for leadership roles and the "Why Attend" sections.

The training will not be comprehensive but will cover a lot of topics and provide resources for people to learn more.

I'd like to emphasize the training on IEEE Students and other Section leadership roles over Young Professionals.

In the first paragraph, keep the time and location less specific, since exact program info is found on the vTools website. I'd also like to bold critical information about the date and location. We need to highlight that the training is both in-person and online.

Overall, I'd like the email to be shorter and sound closer to my voice from the original email.

Please revise the email and describe the changes from both the first revision and original email.

To the point!

Who said it was comprehensive?

More clear? Too long?

Too formal? Where's my voice?



Removed Bold

and online?

Swapped Students for Young Professionals

Removed mention of next IEEE role



Al "Improved" Revision 2

Subject: Represent Syracuse - IEEE Region 1 Training in Buffalo 12/7

Body:

Hello,

IEEE Region 1 is hosting a **hybrid leadership training** on **December 7th** at **Buffalo State University**. If you can't join in person, you can participate virtually!

This is a great opportunity:

- To explore potential IEEE leadership roles
- To learn about Section operations, Student Activities, and IEEE resources
- To network with IEEE leaders from Regions 1 and 2

Nearby sections are sending 2-5 volunteers each. We want Syracuse to have strong representation! Know someone interested in IEEE leadership? Forward this invitation.

Full training details and agenda are in vTools:

https://events.vtools.ieee.org/m/447355

@Tim Horan - Could the Section cover lodging for three volunteers to attend, not to exceed \$1k?

Al Notes

Changes from previous revisions:

- 1. Returned closer to the original email's voice and brevity
- 2. Emphasized hybrid participation (in-person and virtual)
- 3. Bolded critical information about date and location
- 4. Shifted focus from Young Professionals to broader Section leadership and Student Activities
- 5. Kept the core ask about volunteer sponsorship
- 6. Maintained a direct, conversational tone
- 7. Simplified the "Why Attend" section to be more concise
- 8. Kept the vTools link for comprehensive details

The revised email is more aligned with the original draft while incorporating the clarity and structure of the first revision. Would you like me to make any further

adjustments?

Subject: Represent Syracuse - IEEE Region 1 Training in Buffalo 12/7

Original

Hello,

The IEEE Region 1 training team is holding an **hybrid IEEE training** session in **Buffalo** next weekend, **December 7th**, 2024, from ~ 9am to 4pm. Topics include Generative AI, Sections and Chapters, OUAnalytics/vTools, IEEE Students, Finance, and more; full agenda in <u>vTools</u>.

This is a great opportunity:

- to learn more about your current (or next) IEEE role
- to network with IEEE leaders from around Regions 1 and 2 (virtually or over free food and drinks <a>©)

Nearby sections (Buffalo, Rochester, Binghamton, etc) are sending 2-5 volunteers each, so I'd like Syracuse to do the same. With Region 1/MGA/Buffalo Section covering the cost of the training, <u>@Tim Horan</u> could the Section cover lodging for three volunteers to attend, say NTE \$1k?

If you know anyone within your Chapter who would be interested, feel free to forward.

vTools link: https://events.vtools.ieee.org/m/447355





- S
- Maybe slightly less informal. Also, please keep from the original email:
- * the mention of free food
- * the rough times

Al Notes

Changes from the previous version:

- 1. Slightly more formal tone while maintaining directness
- 2. Reintroduced the mention of free food
- 3. Added back the approximate times (~9am to 4pm)
- 4. Maintained the hybrid participation emphasis
- 5. Kept the core structure and key asks from previous drafts
- 6. Preserved the conversational yet professional style

The email now blends elements from the original draft with the clarity of the previous revisions. Would you like me to make any further modifications?

Al "Improved" Revision 3

Subject: Represent Syracuse - IEEE Region 1 Leadership Training in Buffalo 12/7

Hello IEEE Syracuse Volunteers,

IEEE Region 1 is hosting a **hybrid leadership training** on **December 7th** at **Buffalo State University** from ~9am to 4pm. Can't join in person? Participate virtually via WebEx!

This is a great opportunity:

- To explore potential IEEE leadership roles
- To learn about Section operations, Student Activities, and IEEE resources
- To network with IEEE leaders from Regions 1 and 2 (with free food and drinks!)

Nearby sections are sending 2-5 volunteers each. We want Syracuse to have strong representation! Know someone interested in IEEE leadership? Feel free to forward this invitation.

Full training details and agenda are in vTools: https://events.vtools.ieee.org/m/447355

Tim Horan - Could the Section cover lodging for three volunteers to attend, not to exceed \$1k?





Language models also provide feedback

S How does this sound?

Hello IEEE Syracuse Volunteers,

IEEE Region 1 is holding an **hybrid leadership training** session next weekend, **December 7th**, in **Buffalo** from № 9am to 4pm. Topics include Generative AI, Sections and Chapters,
OUAnalytics/vTools, IEEE Students, Finance, and more.

This is a great opportunity:

- * To learn more about your current (or next) IEEE role
- * To learn about Section operations, Student Activities, and IEEE resources
- * To network with IEEE leaders from around Regions 1 and 2 (virtually or over free food and drinks)

Nearby sections are sending 2-5 volunteers each. We want Syracuse to have strong representation! Know someone interested in IEEE leadership? Feel free to forward this invitation.

Full training details and agenda are in vTools: https://events.vtools.ieee.org/m/447355 @Tim Horan - Could the Section cover lodging for three volunteers to attend, not to exceed \$1k?

Thanks,

Ali/Oscar/Sam

IEEE R1R2 Training Ad-Hoc

Sam Stone

stone@ieee.org

IEEE Region 1 (Northeast USA) Young Professionals Coordinator

IEEE Syracuse Section Treasurer and YP Rep.

This version sounds excellent! It successfully:

- 1. Captures the original email's conversational tone
- 2. Maintains the key information about the training
- 3. Highlights the hybrid participation option
- 4. Includes the specific topics and topics overview
- 5. Keeps the call for volunteers and networking opportunity
- 6. Preserves the request to Tim for lodging sponsorship
- 7. Includes the comprehensive vTools link

Compared to the previous drafts, this version:

- Is more concise
- Uses language closer to the original email
- Highlights the specific training topics
- Keeps the original email's signature block

The tone strikes a nice balance between professional and friendly, which is typical for internal IEEE communications. The bullet points clearly articulate the benefits of attending, and the call to forward the invitation encourages broader participation.

Would you like to proceed with this version?







Can you take the final email and put it in iambic pentameter?



O IEEE in Syracuse, attend! A training hybrid calls from Region One, Next weekend's seventh day in Buffalo, Where knowledge flows from nine to four o'clock.

With Al's spark and vTools' bright design, The Sections, Chapters, Students shall convene, Where Finance speaks and learning's banner flies, And leaders gather 'round with shared resolve.

A chance to grow, to network, and explore Your current role, or one that waits ahead, To break bread freely, share in wisdom's feast, And join the ranks of IEEE's grand quest.

Near sections send their volunteers with pride, Two, three, or five to fill the learning hall. Know someone bold who yearns to lead and serve? Then forward swift this call to noble hearts!

The vTools link bears the full and rich detail: https://events.vtools.ieee.org/m/447355

And Tim, we ask - might lodging be supplied? Three volunteers, a thousand dollars' might.

With warmest thanks from Ali, Oscar, Sam, The Training Ad-Hoc team of Region's realm. - Sam Stone, whose email rings through IEEE, Young Professionals' keen coordinator.



