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Demystifying Text-to-Image Generation for K-12 Educators

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Abstract: There is currently a proliferation of digital platforms to perform text-to-image generation. These platforms are breaking new ground in AI tools that let anyone, even beginners, easily create images with professional quality appearance. Are you an educator or a K-12 learning researcher interested in bringing these tools to your classrooms and encouraging responsible use of these technologies by young learners? This tutorial will explore these text-to-image generation platforms with an emphasis on opportunities in K-12 education. In this tutorial, participants will review recent technological development that has led to the rapid advancement of text-to-image generation, explore the components of text-to-image generation - including transformers, latent space, and diffusion - and discuss ethical and societal implications of this technology. Participants will prototype learning activities for a target K-12 age group (concepts for the professional development of teachers is also encouraged) including learning goals, age-appropriate tool introduction, and assessment. The main goal of the tutorial will be to create curricula using this image generation capability that's aligned with our approach of constructionism and computational action.

Organizers

Safinah Ali, MIT Media Lab

Safinah is a PhD student at MIT Media Lab. She has 4 years of experience designing K-12 AI curricula and has designed a creative AI curriculum for middle school students and trained 40 middle school teachers to teach it. She has taught a similar tutorial on creative AI teaching tools at SIGCSE 2021. She has also extensively taught middle and high schoolers about ethical and creative uses of AI around the world.

Prerna Ravi, MIT CSAIL

Prerna is a PhD student at MIT CSAIL. She has 4 years of experience designing learning tools and experiences catered to K-12 students of diverse socio-economic backgrounds as well as those born with varied cognitive and physical abilities. In the past, she has conducted numerous workshops with high school students to introduce programming and mobile app development to them using AI-powered tools like MIT App Inventor. She has also worked with non-profits globally to introduce AI curricula to underserved students by organizing participatory design workshops with their teachers and parents.

Kate Moore, STEP Lab

Kate Moore is a research scientist who studies how to teach teachers as well as middle and high school students about systems and ethics of artificial intelligence and machine learning. She earned her doctoral degree at Teachers College, Columbia University, where she studied cooperative learning and collaborative problem solving, and worked part-time as a professional development coach for STEM teachers in New York City public schools with the Center for the Professional Education of Teachers (CPET).

Cynthia Breazeal, MIT Media Lab

Cynthia Breazeal is a professor of media arts and sciences at MIT, where she founded and directs the Personal Robots group at the Media Lab. She is the MIT dean for digital learning and the director of the MIT-wide

Initiative on Responsible AI for Social Empowerment and Education (raise.mit.edu). She has led several research and outreach efforts that advances access and inclusivity in AI education to people of all ages and backgrounds with a focus on K-12 and the workforce.

Hal Abelson, MIT CSAIL

Harold (Hal) Abelson is Class of 1922 Professor of Electrical Engineering and Computer Science at MIT known for his contributions in computing education. He is a pioneer of constructionist learning and computational thinking. He has developed tools and programming languages to help students learn about AI and computer science. He leads the MIT App Inventor project that empowers people with little programming experience to write AI-enabled mobile applications. He is also the co-director of MIT RAISE (Responsible AI for Social Empowerment and Education). He is a leader in the global movement for Open Educational Resources and has played key roles in fostering MIT institutional educational technology initiatives including MIT OpenCourseWare and DSpace.

Intended audience

This workshop is catered to an audience comprising of K-12 educators as well as computer science (CS) and artificial intelligence (AI) education researchers.

Duration of the event

Full Day

Description of the workshop

Themes and goals

Text-to-image generation technologies such as Stable Diffusion, DALL-E and Midjourney have become extremely popular in recent months garnering interest from people even outside of the AI community, including educators and K-12 students. These powerful tools can generate high quality visuals from natural language prompts and are open to access for anyone. These tools can have infinite creative potential when used by K-12 learners and educators but are also accompanied by serious ethical implications. However, currently educators and their students don't necessarily have a good understanding of how these tools work or how they can be possibly used or misused. In this tutorial, we will demystify text-to-image generative tools for K-12 educators as well as learning science researchers, and work along with educators to design teaching lessons and curricula around bringing these tools to the classroom. The goal of the workshop is for educators and K-12 learning researchers to gain a clear understanding of how these generative tools work, and co-designing with them learning tools, lessons or curricula to teach K-12 students about them.

Theoretical background and relevance to field and conference

Text-to-image generation platforms are breaking new ground in AI tools that empower beginners by letting anyone easily create images with professional quality appearance. These platforms use massive datasets comprising labeled images scraped from art blogs, museum websites, fanfiction sites, etc. The datasets are used to train chains of neural networks and large language models, which learn to generate novel images that can mimic human gestures, tones, faces, and voices with uncanny accuracy. AI Literacy - the ability to understand and work with these generative AI tools - is of multi-disciplinary interest and has the potential to open doors to many future careers.

From an educational perspective, text-to-image generation offers students a double-edged sword: powerful new tools for self-expression, infused with the societal biases baked into the training data. How so we help students (and their teachers) demystify these tools and develop their AI Literacy along with an understanding of the ethical and socio-technical implications of bias in AI? This is a pivotal question for educators and researchers in the learning sciences as generative AI platforms, such as DALL-E and ChatGPT, have recently proven themselves able to disrupt traditional processes with which we, in the learning sciences, measure learning outcomes. How will students express their thinking or refine their craftsmanship if an AI can generate their work for them? This tutorial is designed to engage educators and learning scientists in possible answers

to these questions by sharing insights gleaned from a) recent research on AI Literacy, specifically generative AI, in middle and high school settings, b) current research on professional development models for building teachers' AI Literacy, and c) discussion and projects created during a pilot seminar on text-to-image generation run by researchers at MIT's Responsible AI for Social Empowerment and Education (RAISE) initiative [https://image-gen.github.io/]. The tutorial will culminate in a project-based activity drawing from constructionism and computational action to expose participants to culturally-sustaining, hands-on methods of teaching about text-to-image generative platforms and empower learners to critically and creatively engage text-to-image platforms as tools for communication and critical engagement with media.

Workshop activities

Introduction

Exploring generative AI models and their relevance in K-12 AI Literacy

- What are language inference and visual generative AI models and how do they work?
- Examples of generative media
- Motivation for teaching this to K-12 students: new media and possibilities for creation and computational creativity, as well as their ethical considerations

Text-to-image generation platforms

Experimenting with the latest generative AI platforms

- Survey and experiment with some existing platforms: DALL-E 2, Stable Diffusion and Midjourney.
- Introduction to prompt engineering
    - Tips and tricks to create better prompts.
- Complete two activities using them: creative AI storytelling and self-portraits: Description and examples of these two activities taken from our pilot seminar are linked on our pilot seminar website-- https://image-gen.github.io/.
- Reflect on your experience of creating images for the activities above - what role did the AI tool play, how this technology can be used or misused, and how is it relevant to K-12 students.

Understanding how the technology behind text-to-image generation tools works

- How do generative algorithms like stable diffusion work?
- How do natural language models fit into this?

K-12 generative AI literacy

- Hands-on activity to investigate existing creative AI curriculum in K-12 education.
    - Review literature in the area and identify gaps and opportunities in K-12 creative AI literacy, especially pertaining to language driven image generation.
    - Brainstorm how might students encounter and experience using these tools.
    - Identify what students need to be aware of when using these tools.
- Discuss ideas on what can educators do with text-to-image generation tools.
    - Redesigning assessments
    - Using these as educational tools
    - Developing teacher AI literacy

AI literacy proposals

- Design and share proposals for learning activities surrounding creative AI literacy.
    - Factors to consider: target age group, learning goals, generative AI tools used, learning activities & assessment.
    - Deliverables can include curricula, learning lessons, interactive tools or assessment methods.
    - Guidelines for designing teacher professional development (PD) is highly encouraged.

Expected outcomes and contributions:

Educators and researchers will gain an understanding of how text-to-image generation tools work and what their societal and ethical implications are. They will brainstorm techniques to bring these tools to the classrooms and teach students about the creative potential and responsible use of generative AI tools.