TOTALLY BURNT - AND STILL LEGIBLE!

Italy in the year 79 A.D., southeast of today's Naples. The earth shakes for days. Then an explosion, a cloud of ash. The blocked vent of Vesuvius is cleared, but it is a catastrophe for the region: Falling ash and mud cover the area, including the towns of Pompeii and Herculaneum, several meters high, and thousands of people die.

1700 years later, an Italian farmer accidentally unearthed a charred, fragile scroll. Eventually, hundreds of such scrolls come to light. They came from one of the largest known Roman libraries, known as the Villa dei Papiri. Unlike other ancient documents, they are intact, but their fragile condition makes them unreadable. **What a shame, isn't it?**

But in 2023, a breakthrough!
Using special X-rays, researchers were able to reveal fragments of writing (i.e., parts of letters) and irregularities on the scrolls. But what does it say? The texts are illegible for humans. However, two students managed to decipher words on the scrolls. What a sensation! How did they manage it?

This is what the charred scrolls look like in real life. The 3D model you see in the station is a scan of one of the papyrus scrolls found.

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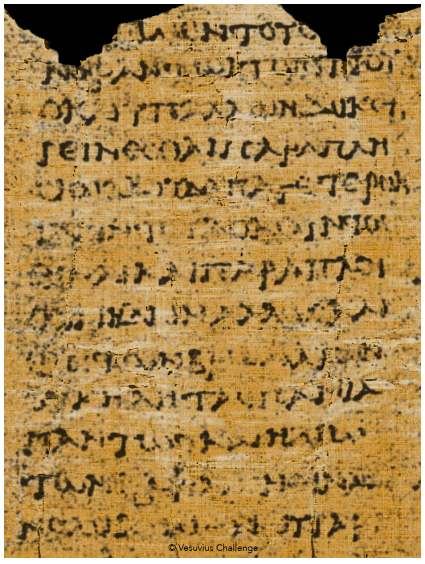
They used AI systems for decoding. Both AI systems were first trained with letters and words in Greek script. One AI system then searched the X-ray images for patterns in the structure (called "crackle" patterns) that could indicate letters. And indeed, the AI system found several lines that corresponded to a Greek word.
At the same time, a second AI system was trained. This looked for irregularities (called anomalies) in the X-ray images, and this AI system also found lines that pointed to a Greek word.
In fact, both AI systems found the same word at the same time. The word is:

Shown here once in Greek characters and once in our Latin script. It means *purple*. And of course, once you can read one word, it becomes easier to identify others! This is why these and other AI systems can gradually succeed in making the contents of other papyrus scrolls readable.

You have followed the same procedure as the AI systems:

The letter template has shown you what the text you are looking for looks like. By comparing these letters to the fragments, you can complete the writing so that you can read it.



These images show text from inside the reels, reconstructed by AI systems.

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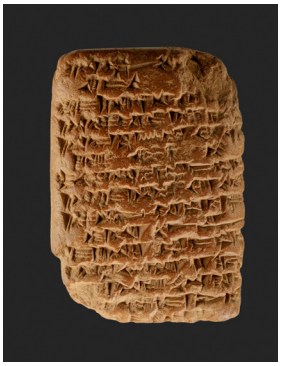
By the way, both AI systems use neural networks. You can learn more about this in Station 03. Of course, AI systems are not only used in archaeology to decipher texts. They can also be used to evaluate images of soils and landscapes, or to reconstruct objects as realistically as possible.

Sorting pottery shards from ancient vessels is tedious. AI systems can help here, too: they can sort the shards better and more accurately than humans.

Reading cuneiform is difficult, tedious, and time-consuming. AI systems accelerate reliable deciphering and comparison with tablet collections worldwide.



Link to the Vesuvius-Challenge, https://scrollprize.org/

Fun fact: The AI systems used to decipher the papyrus scrolls were developed as part of the Vesuvius Challenge. The two students won a large cash prize, and the challenge is still ongoing: the goal now is to decipher even more characters. So it might be worthwhile for you to get involved with AI systems and archaeology in the future...

Many thanks to PD Dr. Kilian Fleischer and the Vesuvius Challenge team for providing 3D scans and images of the real papyrus scrolls from the research project!

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SOURCES

Images Charred papyrus & Greek text and 3D model papyrus scroll

Provided by PD Dr. Kilian Fleischer, Eberhard Karls Universität Tübingen, und dem EduceLab/University of Kentucky (Vesuvius Challenge)

Papyrus wallpaper

https://pixabay.com/de/illustrations/pergament-papyrus-schmutz-alt-880314/, Photo by Gerd Altmann

Context Clay fragments

Photo by Tonscherben in der Kapelle von Ain Sa'af, Senke el-Charga, Libysche Wüste, Ägypten, Photo by Roland Unger, CC-BY-SA 3.0, https://commons.wikimedia.org/wiki/File:AinSaafChapelCeramics.jpg

Publikation:

Leszek M. Pawlowicz, Christian E. Downum (2021). *Applications of deep learning to decorated ceramic typology and classification: A case study using Tusayan White Ware from Northeast Arizona,* Journal of Archaeological Science, Volume 130, 105375, ISSN 0305-4403, https://doi.org/10.1016/j.jas.2021.105375.

Context Cuneiform

https://www.metmuseum.org/art/collection/search/544695, The Met, Public Domain Image

Publikation:

Ernst Stötzner, Timo Homburg, Jan Philipp Bullenkamp, Hubert Mara (2023). R-CNN based Polygonal Wedge Detection Learned from Annotated 3D Renderings and Mapped Photographs of Open Data Cuneiform Tablets. In: Alberto Bucciero, Bruno Fanini, Holger Graf, Sofia Pescarin, Selma Rizvic (Eds.), *Eurographics Workshop on Graphics and Cultural Heritage*, The Eurographics Association, ISBN 978-3-03868-217-2, https://doi.org/10.2312/gch.20231157.

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