Leveraging Generative AI to Modernize Applications

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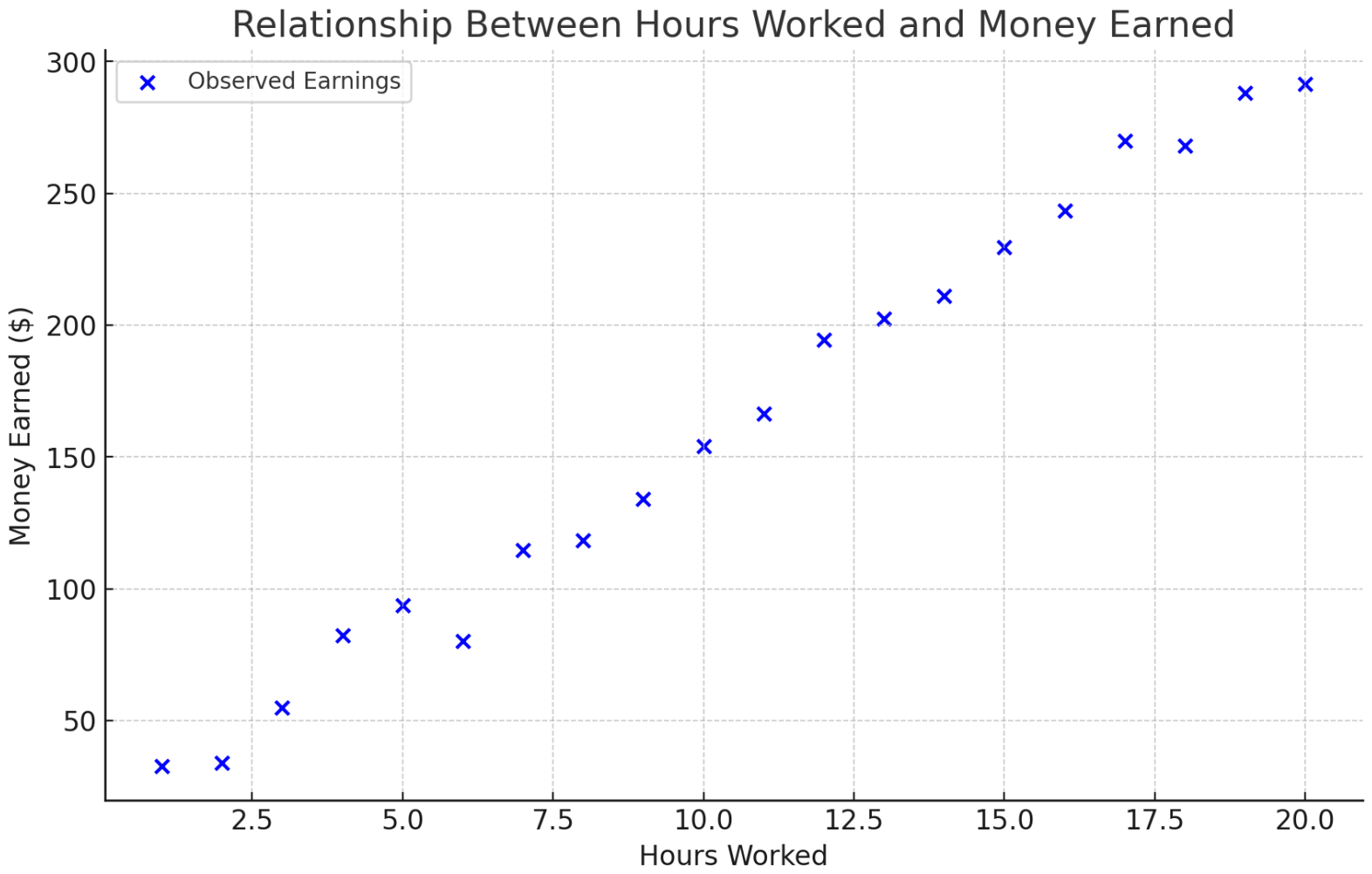
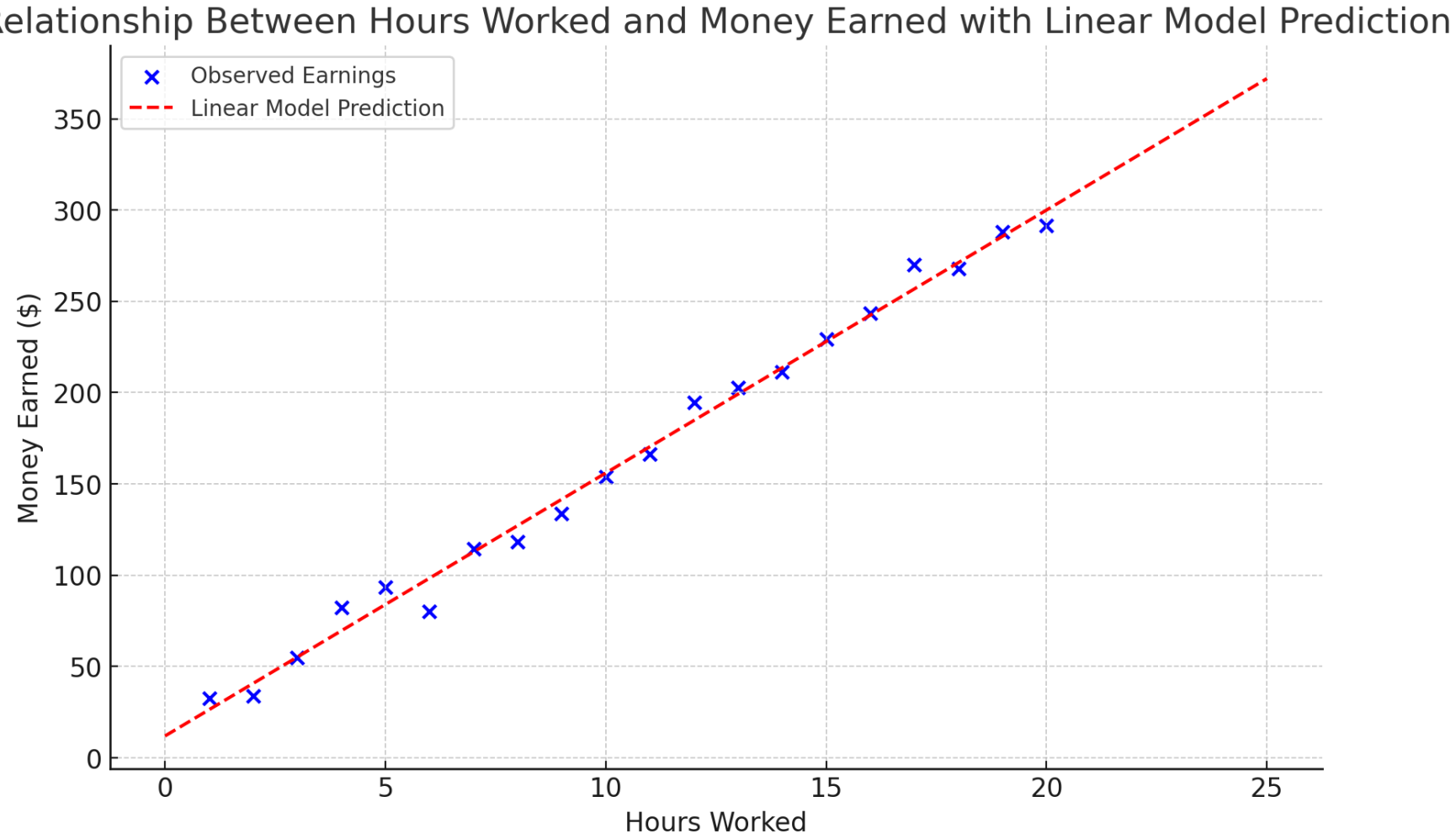
What is a model?

- A mathematical representation of a real-world process.
- When you supply some input to the model, the model can process it and relate it to some output.

What is a Model?



What is a Model?



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Generative AI is just a model

(albeit a very complicated one!)

Use Case Number 1

Decoding the Past: Using Generative AI to Navigate Legacy Code

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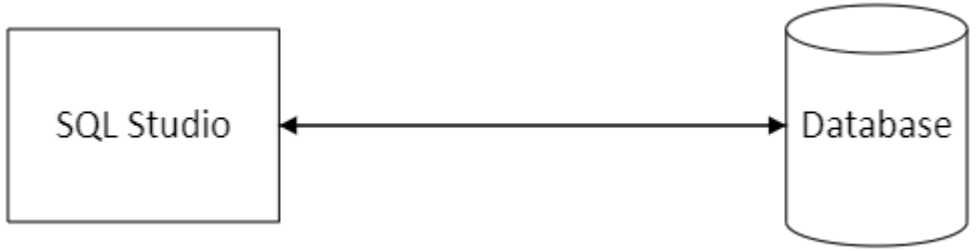
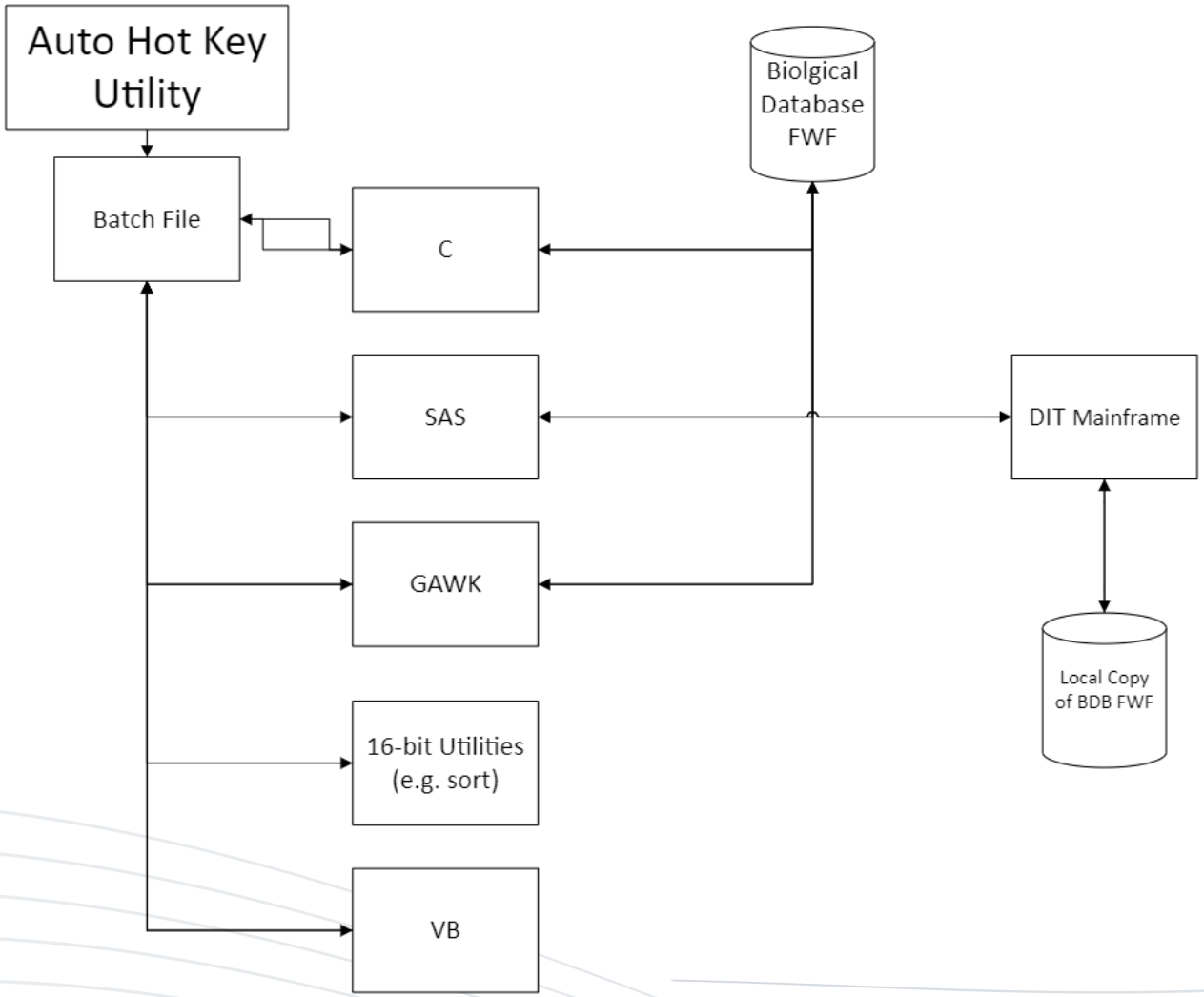
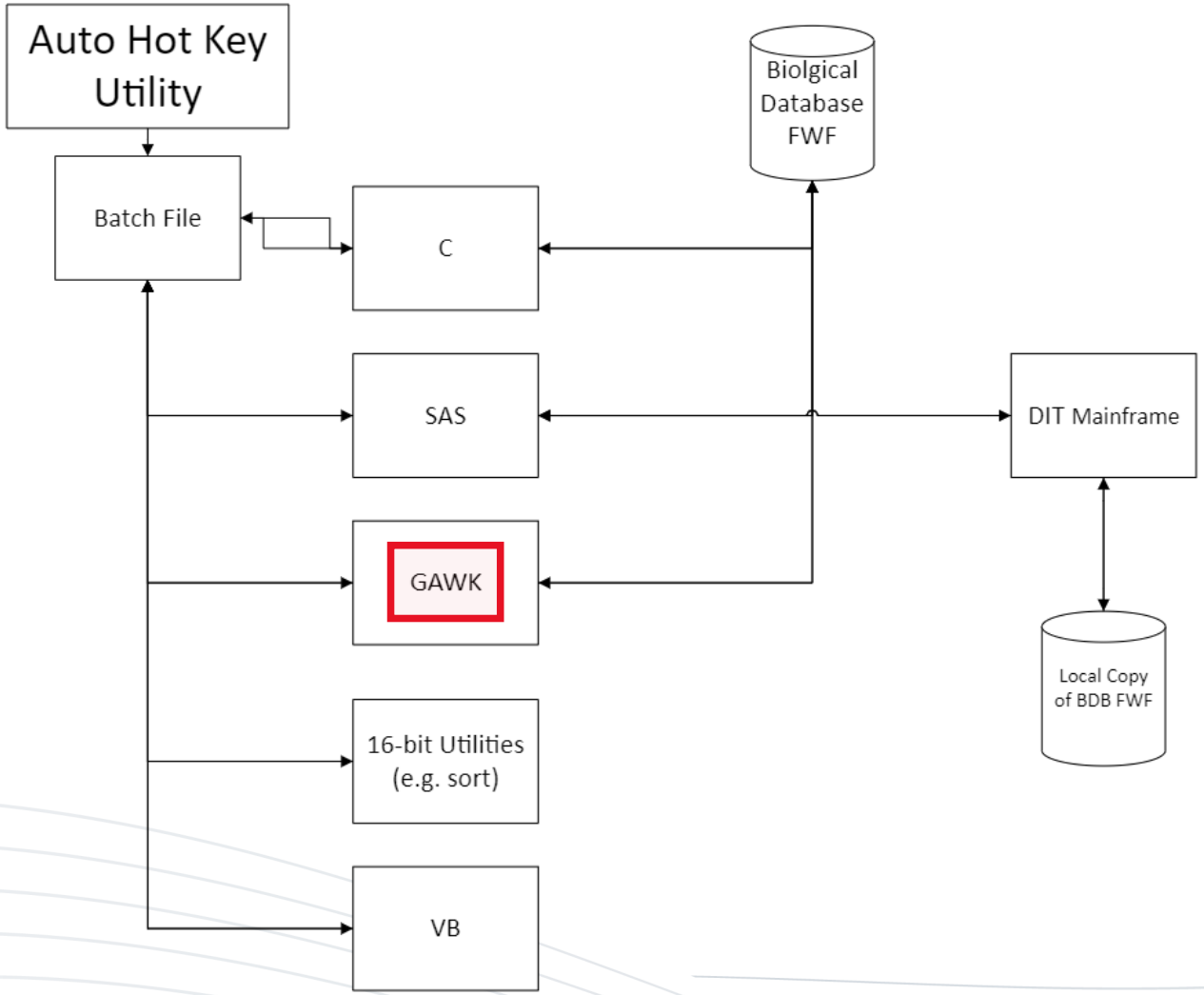
Use Case No. 1



Use Case No. 1


Auto Hot Key Utility
Batch File
Biolgical Database FWF
C
SAS
GAWK
16-bit Utilities (e.g. sort)
VB
DIT Mainframe
Local Copy of BDB FWF

Use Case No. 1


Auto Hot Key Utility
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16-bit Utilities (e.g. sort)
VB

AWK is a powerful text-processing language commonly used in Unix/Linux environments to manipulate and analyze structured text data

I love AWK because it allows me to build the wrong solution to problems so quickly :)

-Dave on Stack Overflow

If we wanted to hire an AWK expert, we would need to recruit from a retirement home, not a university!

-Anonymous

Use Case No. 1

```
BEGIN{k=1;i=1;nr=1;fc=1; hpset="\x1b(8U\x1b\x26\x6c\x31\x4f\x1b\x26\x6c\x31\x53\x1b\x26\x6c\x38\x44";
hp16="\x1b\x28\x73\x33\x34\x48\x1b\x26\x6c\x32\x43";#hp12="\x1b\x28\x73\x31\x37\x48\x1b\x26\x6c\x34\x43\x1b(s7B";}hp
12="\x1b(6N\x1b(s0p16.67h8.5v0s0b0T\x1b\x26\x6c\x35\x43";
}{if(NR==1)fn=FILENAME;}{if(fc==1){if(fn==FILENAME){spc=substr($0,27,10);if(spc ~ /^[0-
9]/){for(jj=length(substr($0,38));jj>0;jj--)if(substr($0,37+jj,1)==" ");else
break;sp[spc]=substr($0,38,jj);}next;}else{fn=FILENAME;fc++;}}}{if(fn==FILENAME);else{if(i){i=0;pt(n,l,w,k,id,f);c[id]=k;print
hpset "CONTENTS OF TRANSACTION FILE: " FILENAME " "AKA;}id=substr($0,2,1);
if(svid==id);else {svid=id;if(id ~ /[3459]/){print  hp16 f[id];latin( );}else print  hp16 f[id]"\n";}z="";for(y=1;y<c[id];y++)z=z
substr($0,b[id,y],w[id,y]) "|";if(id ~ /[3459]/ && spc != substr($0,12,10)){latin( );}printf("%s%03d %s\n",hp12,nr++ %
1000,z);next}}
{if($1==id){ n[id,k]=$2;l[id,k]=length($2);b[id,k]=$3;w[id,k++]=$4;}else{if(NR==1);else {pt(n,l,w,k,id,f);c[id]=k;}
k=1;id=$1;n[id,k]=$2;l[id,k]=length($2);b[id,k]=$3;w[id,k++]=$4;f[id]="";}}function pt(n, l, w, k, id, f,     j, p, q, r, s, t, e, u){\e="
";
p=0;for(j=1;j<k;j++)if(l[id,j]>p)p=l[id,j];for(j=1;j<=p;j++){for(q=1;q<k;q++){t=2*w[id,q];r=int(t/2);t=t-r;u=" ";#if(j==p)u="|";else u="
";if(l[id,q]<1+p-j)s=s substr(e,1,r+t+1)u;else s=s substr(e,1,r)substr(n[id,q],j-(p-l[id,q]),1)substr(e,1,t)u;}if(f[id]=="")f[id]="       "
s;else f[id]=f[id] "\n       " s;s="";}}function latin( ){spc=substr($0,12,10);print hp16 "                                    " sp[spc]"\n\n";}
```

Use Case No. 1

6500 Lines

And this was just one script!

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Disclaimer:

We use a version of ChatGPT that does not save any of our inputs and does not train on our data.

We can delete our data at any time.

OpenAI

Demonstration

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Use Case Number 2

Bridging Expertise Gaps: Empowering Cross-Disciplinary Collaboration with Generative AI

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NCDMF Ageing Program

- The program harvests ageing structures from fishes throughout the year to determine fish ages for modelling
- Otoliths are the most common structure

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NCDMF Ageing Program

- 12,209 age samples collected in 2023
- 9,596 age samples were read
- This is a manual process!

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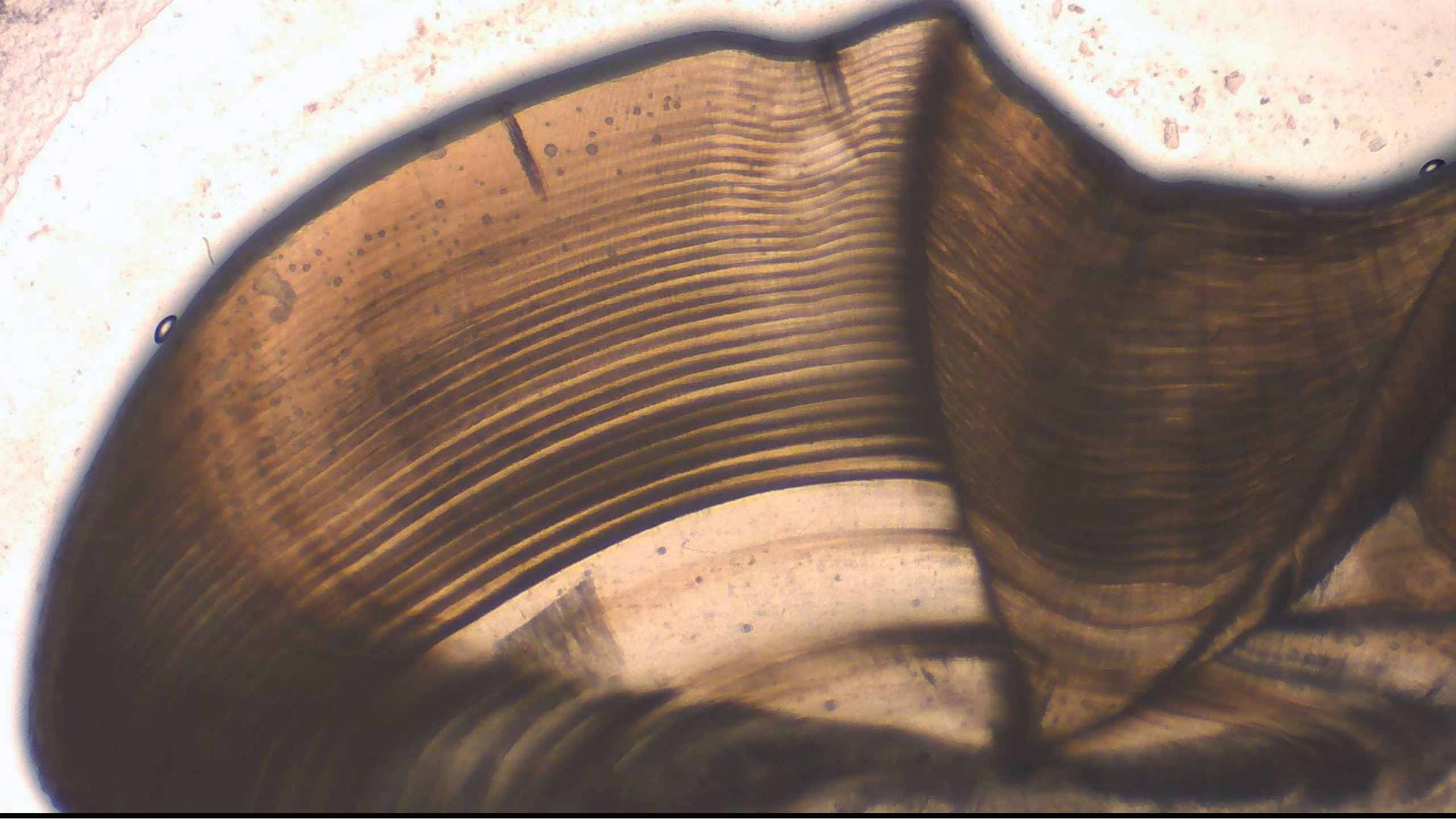

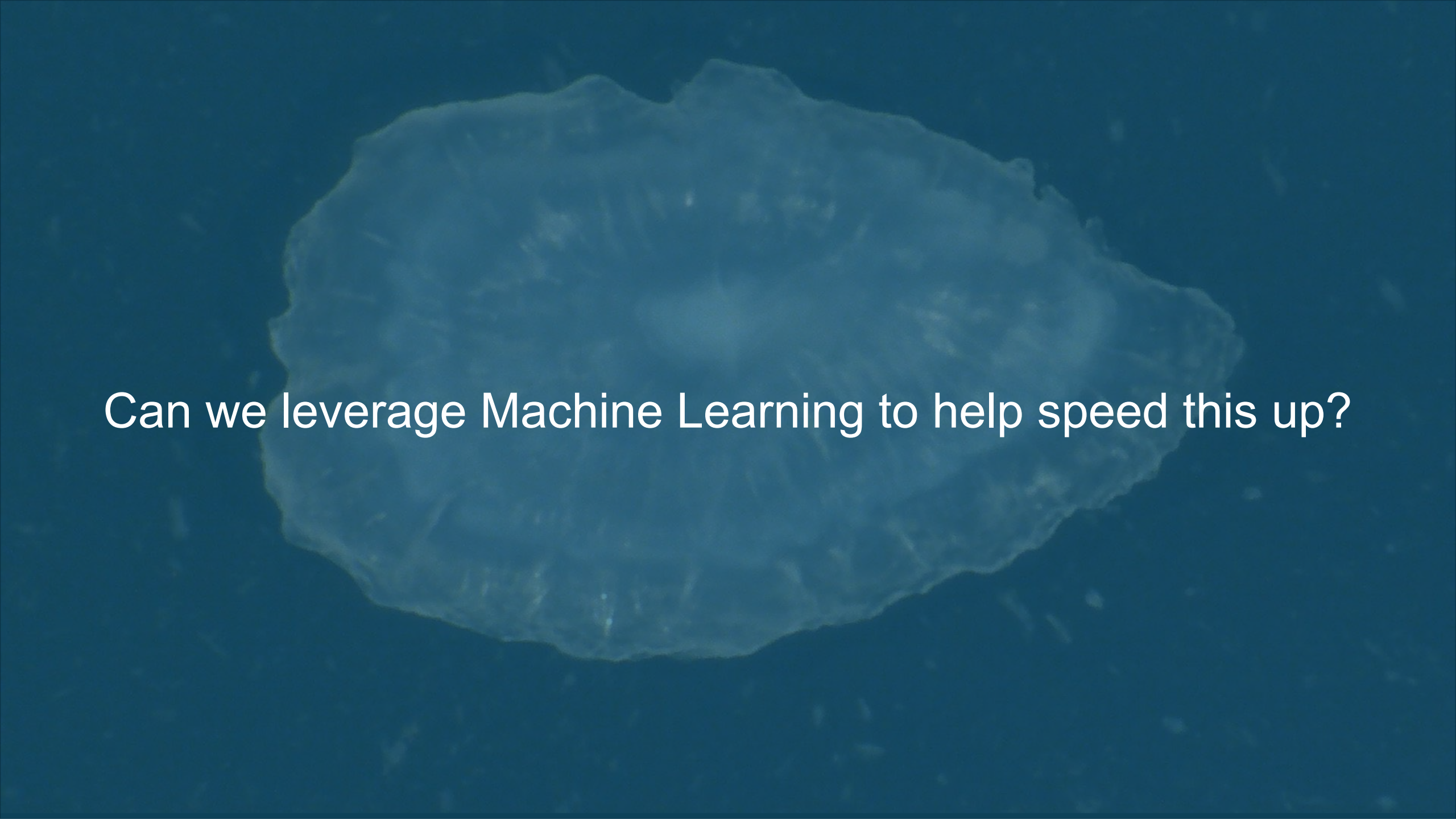
Can we leverage Machine Learning to help speed this up?

Humans:

~30 Seconds – 1 Minute per otolith

Convolutional Neural Network:

~0.01 Seconds per otolith

Images processed by a human in one minute:

$$\text{Images per minute} = \frac{60 \text{ seconds}}{30 \text{ seconds per image}} = 2 \text{ images per minute}$$

4,798 Minutes Total

x3 People

Images processed by a CNN in one minute:

$$\text{Images per minute} = \frac{60 \text{ seconds}}{0.01 \text{ seconds per image}} = 6,000 \text{ images per minute}$$

1.59 Minutes Total

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Use of GenAI

- Walks you through code creation for a CNN
- Helps you understand the stats, functions, and tests
- Gives tailored guidance on errors, optimizations, etc.

```
# Load the image
image = cv2.imread('C:\\Users\\Scott\\Documents\\Otolith Project\\img\\1511232-1.jpg')

# Convert the image to grayscale
gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

# Apply Gaussian blur
blurred = cv2.GaussianBlur(gray, (5, 5), 0)

# Apply adaptive threshold
thresh = cv2.adaptiveThreshold(blurred, 255, cv2.ADAPTIVE_THRESH_GAUSSIAN_C, cv2.THRESH_

# Erosion and dilation to remove noise
kernel = cv2.getStructuringElement(cv2.MORPH_ELLIPSE, (5,5))
thresh = cv2.erode(thresh, kernel, iterations=1)
thresh = cv2.dilate(thresh, kernel, iterations=1)

# Find contours
contours, hierarchy = cv2.findContours(thresh, cv2.RETR_EXTERNAL, cv2.CHAIN_APPROX_SIMPL

# Iterate over the contours and save the cropped otoliths
count = 0
for i, contour in enumerate(contours):
    area = cv2.contourArea(contour)

    # Filtering based on area
    if area > 500:  # you can adjust this threshold as needed
        x, y, w, h = cv2.boundingRect(contour)
        cropped_otolith = image[y:y+h, x:x+w]
        cv2.imwrite(f'cropped_otolith_{count+1}.jpg', cropped_otolith)
        count += 1
```

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Thank You

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