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Technical Writing HQ- Capstone Project
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A Preview of “Forensic Applications of Matrix-Assisted Laser Desorption/Ionization Mass Spectrometry”

Abstract

Matrix-Assisted Laser Desorption/Ionization Mass Spectrometry (MALDI MS) is a useful technique for the analysis of crime scene evidence in the field of forensic chemistry as well as drug analysis in clinical chemistry. Ranging from the analysis in the detection of drugs in skin, and specifically, latent fingerprints, to analysis of drugs present in hair samples, MALDI MS can also be useful for detecting the presence of different biofluids and possible contaminants at a crime scene. To understand its application in these different areas of forensic chemical analysis, this paper also explores several effective matrices for the application of MALDI MS.

Overview of the MALDI MS Technique

Matrix Assisted Laser Desorption/ Ionization (MALDI) Mass Spectroscopy (MS) is a soft ionization technique, which indicates that this technique is less likely to cause fragmentation when the analyte is irradiated with the laser following MALDI MS application. Additionally, fragmentation is less likely to occur when the matrix used has a high salt tolerance resulting in the production of single or lower-charged ions. This is one reason why it has been useful in the direct analysis of proteins in complex samples including those containing biofluids such as blood, urine, and saliva as well as enzymes, and other biological function-related macromolecules such as peptides and sugars, amino acids, and carbohydrates.¹

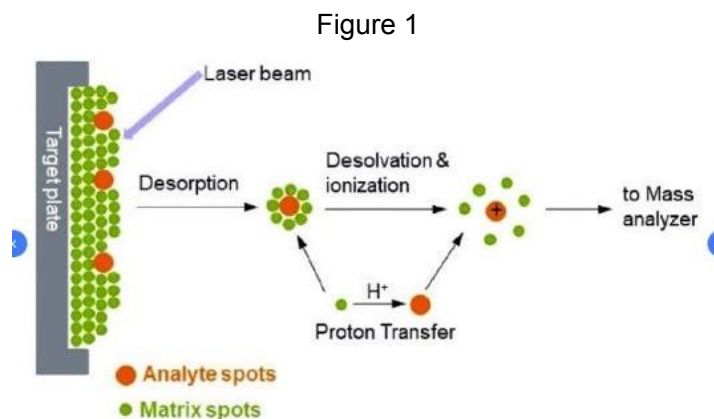
In its discovery, scientists successfully analyzed the amino acid, Alanine, with amino acid, Tryptophan, acting as the matrix. Tryptophan easily ionized alanine without absorbing the laser energy. Following this experiment, scientists applied the same concepts to combine Cobalt with Glycerol using a nitrogen laser for ionization. As a result, they determined that proteins and other large molecules could be ionized by the laser and then analyzed by a mass spectrometer.

Thus, MALDI MS follows this process:

1. The matrix used in the experiment, often α -cyano-4-hydroxycinnamic acid (CHCA), is mixed with the analyte, which is usually the drug or chemical compound under evaluation.
2. This mixture is then crystallized through a drying method.
3. Once crystallized, the sample is placed on the target plate that will be directly irradiated by the laser beam. The laser will desorb and ionize the analyte through protonation or deprotonation.

4. After ionization, the analyte can be analyzed by the mass spectrometer to produce the m/z signals (M^+ peaks) observed in the collected spectra.¹

It is important to note that the matrix is the absorber of the laser energy in this process. Though analyte ions are produced and observed in the spectra, signals can be suppressed if salt contaminants are present in the matrix. Figure 1 below can be used to visually summarize the MALDI MS process discussed above.²



Frequently, chemical or enzyme catalytic-based tests of biofluids in forensic chemistry are limited by time consumption, low throughput, poor sensitivity, low specificity, and large sample consumption.³ These issues are remedied with the application of MALDI MS, especially when combined with other analytical techniques including Ultraviolet Visible Spectrometry (UV-Vis) and/or Liquid Chromatography (LC). MALDI MS is successful in accurately identifying complex molecules while avoiding large sample consumption, and maintaining high specificity regardless of the time since sample collection, and speed at which analysis takes place.⁴

Due to its accuracy and precision, this analytical technique is used widely in forensic and clinical chemistry, specifically in studies regarding mammalian and plant tissue. MALDI MS has been linked to the successful analysis of pesticides in plant tissue and xenobiotics in porcine skin, which is useful in the study of pesticide effects on human health.⁵ In parallel, the chemical pathways of xenobiotics in porcine skin can be compared to the chemical pathways of xenobiotics in human skin because humans and porcine share a similar epidermis and up to 98% DNA. Tissue in skin, fingerprints, and hair samples can also be analyzed for the detection of xenobiotics and their chemical pathways throughout the human body, which can help in crime scene investigations.

References

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- ² Figure 1: Veeravalli, V.; Madgula, L. M. V.; Srivastava, P. Mass Spectrometry as a workhorse for preclinical drug discovery: special emphasis on drug metabolism and Pharmacokinetics. In *Mass Spectrometry- Future Perceptions and Applications*. 2019. DOI:10.5772/intechopen.88385.
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- ⁴ Kennedy, K.; Heaton, C.; Langenburg, G.; Cole, L.; Clark, T.; Clench, M. R.; Sears, V.; Sealey, M.; McColm, R.; Francese, S. Pre-validation of a MALDI MS proteomics-based method for the reliable detection of blood and blood provenance. *Nature*. 2020, 10: 170-187.
- ⁵ Hart, P. J.; Francese, S.; Claude, E.; Woodroffe, M. N.; Clench, M. R. MALDI MS imaging of lipids in ex vivo human skin. *Anal. Bioanal. Chem.* 2011. 401: 115-125.

Proposal for Weekly Performance Reports

Issue:

Several Geniuses and Technical Experts who train and mentor technical specialists, including myself, have noticed technicians are unknowingly misusing company time and resources. This impacts the *customer service appointment acceptance rate* as well as the *successful repair completion rate*. Technicians don't have a way to measure their impact on the customer journey.

Solution:

After speaking with the technicians that are frustrated by the lack of accountability, I propose that technicians receive weekly performance reports detailing factors that impact the customer journey. These reports would not only help drive the weekly conversations between manager and technician, they would also allow employees to visually understand their contributions to their team.

Weekly Performance Reports will include:

SUR (Same-Unit Repairs)	Tracks technician's percentage of successfully completed repairs
DOA/DDR (Dead-On-Arrival Parts or Damaged During Repair Parts)	Tracks technician's percentage of parts that were damaged during repair
NTF (No Trouble Found)	Tracks technician's percentage of repairs performed on previously functional devices
POS (Point of Sales)	Tracks technician's percentage of post-repair devices requiring price adjustments due to expectations set or exceptions made during appointment
UR (Unreported Damage)	Tracks technician's percentage of devices shipped to our return center with unreported damage
SD (Session Duration)	Tracks technician's average time spent during a service appointment with customer

SPQH (Sessions Per Queued Hour)

Tracks technician's number of service appointments accepted per hour

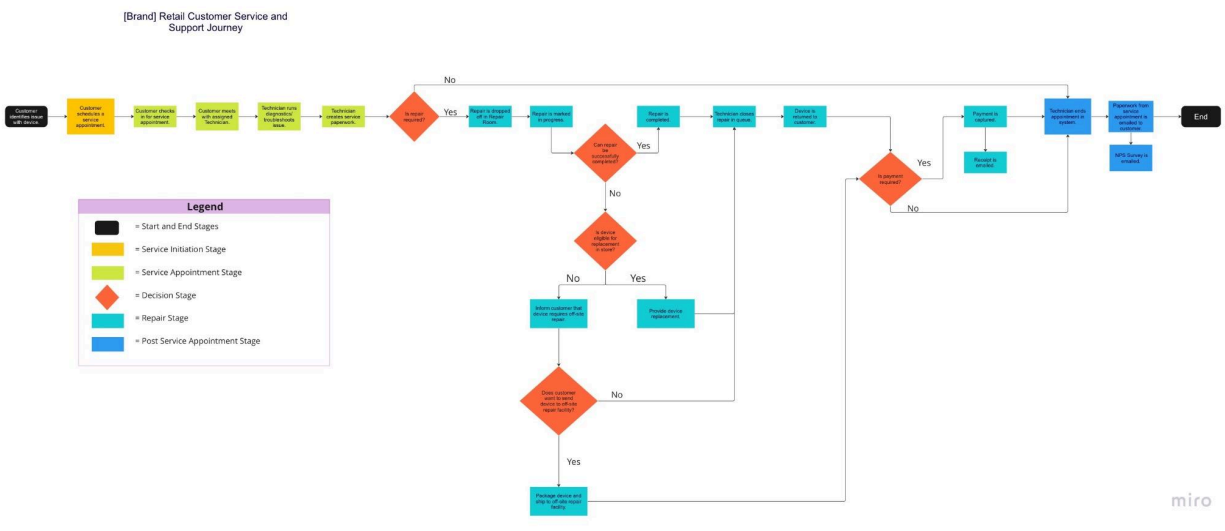
As mentioned, this data is being considered due to the direct impact on the customer journey as well as the impact to company revenue, and service technicians' performance. While these are not the only metrics to include in these weekly reports, I hope this will provide the accountability our team needs.

[Brand] Retail Customer Support Journey Map

This map is a visual reference detailing the phases in the technical support journey in the [Brand] retail environment. Technicians will review this map during onboarding for a general overview of their responsibilities.

For ease of visibility, please access map using provided link:

https://miro.com/app/board/uXjVMfVjov8=/?share_link_id=851451077864



GoGuardian Teacher FAQs

How do I use a *scene*?

A *scene* allows you to apply specific conditions or filters to your session. For example, if you want to allow access to Google Classroom only, you can create a scene that restricts all websites except Google Classroom.

Can I add a *scene* though a session is already in progress?

Yes. Once in session, you can click on the “No Scene Applied” drop-down menu on the top right of the screen to apply a new or premade *scene*.

Can I block multiple websites that redirect to the same content?

Yes. When you are creating your *scene*, insert an * after your website name (Youtube*) to block all websites that contain that phrase in the URL. The same can be done to allow all websites.

Can I schedule multiple sessions in advance?

Yes. On the left-hand side, locate the “Classrooms” tab. Once a classroom has been created, select settings for that classroom. The “Scheduling” tab will become visible allowing you to schedule as many sessions as you want.

Can I communicate with a specific group of students using the chat feature?

No. You can either create an announcement for the whole class, or individually chat with students.

Am I able to view a report of a student’s activity during a session though the session is over?

Yes. When you click on a classroom, a list of previous sessions appears including a chat log for that session.

Select the date of the session you want to view, and a list of students will appear along with a summary of visited websites, and time spent on each website.

If I have a coteacher, can we monitor the same session?

Yes. Make sure that the coteacher or any other assistant is added to the classroom.

Friday, January 6, 2023 | 1:00 PM | Rm G132

Attendees

- o Sam Smith, Principal
- o Jessica Jones, Director of Curriculum
- o Megan Meents
- o Diana Dietz
- o Kelsey Kelly
- o Cristina Campbell
- o Eric Eastwood
- o Nicole Newman

Agenda

Open Issues	<ul style="list-style-type: none">o Transportation for 8th grade field tripo IAR preparation websites and schedulingo Missing content materials
New Business	<ul style="list-style-type: none">o School board meeting apologyo IEP/504 meeting structure updateo High school counselor visitso Graduation—traditional vs. virtual structure, and possible date and timeo Student-of-the-month nominations
Action Items	<ul style="list-style-type: none">o Contact ROE Nicole Newman for follow-up of missing content materialso Meet with head of transportation, Sandra Sullivan, to adjust transportation needs
Notes	<ul style="list-style-type: none">o Student C.N requested transfer of classes, meeting with parents will need to be set up to discuss bullying issue

Next Meeting: Friday, January 20, 2023 at 1:00 PM

Meeting adjourned at 2:45 PM by Sam Smith, Principal

Embedding PDF Files in Apple Notes App

Overview:

This document details the process of embedding media such as pdf files and text from captured images and videos in the Apple Notes app to simplify note-taking strategies.

How to embed a PDF file

Three Dots Method

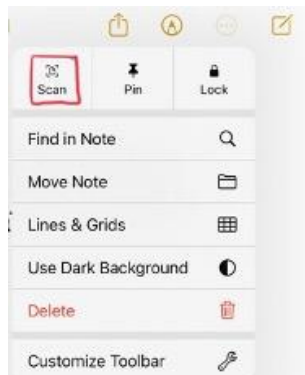
1. Open the **Notes** app.
2. Create a New Note by selecting the pencil in a square icon in the top right corner of the screen. A new blank note will appear.



3. Select the **Three Dots** icon at the top right corner of the screen. A selection pane will appear.



4. Select the **Scan** option in the selection pane that appears.



Selection Pane

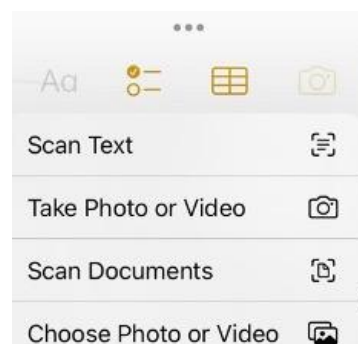
The camera will open to scan physical or digital documents. By default, documents are automatically scanned. Also, they can be manually adjusted.

5. Take a picture of the document, and adjust dimensions as needed.
6. Select **Keep Scan** once the document has been adjusted. Repeat for any remaining documents.

7. Select **Save** once all documents have been scanned. Documents will appear as pdf files within the note.
8. If a document is missing within the scanned pdf file, it can be added afterward. Select the pdf file inside the note to view editing options.
9. Select the plus sign on the bottom left corner of the screen. The camera will reappear to scan additional documents within that pdf file.
10. Select **Save** and the pdf file will be updated in the note.

Notes App Camera Method

1. Open the **Notes** app.
2. Create a New Note by selecting the pencil in a square icon in the top right corner of the screen. A new blank note will appear.
3. Select the **camera** icon in the top center of the screen. A selection pane will appear.



Selection Pane

4. Select **Scan Documents** to create a pdf file that will be embedded in the note.

The camera will open to scan physical or digital documents. By default, documents are automatically scanned. Also, they can be manually adjusted.

5. Take a picture of the document, and adjust dimensions as needed.
6. Select **Keep Scan** once the document has been adjusted. Repeat for any remaining documents.
7. Select **Save** once all documents have been scanned. The scanned documents will appear as a pdf file within the note.
8. If a document is missing within the scanned pdf file, it can be added afterward. Select the pdf file inside the note to view editing options.

9. Select the plus sign on the bottom left corner of the screen. The camera will reappear to scan additional documents within that pdf file.
10. Select **Save** and the pdf file will be updated in the note.

Work Authorization and Service Report

This document is an example report for new technicians to view during onboarding.

Technicians will need to create a report during each service interaction between technician and customer. Moreover, each report recaps the service appointment and acts as an official, legal agreement between the customer and our company.

Example Report

Customer/ Device Information

Customer Name:

Customer Contact Information:

Alternate Contact Information:

Device Serial Number:

Issue

- Customer states that their phone has a Face ID issue.
- They cannot unlock their device using Face ID though they were previously able to.
- The customer went into their settings to reset their Face ID where they discovered that the option to remove and set up Face ID was greyed out.

Steps Taken (in Store) to Resolve Issue

- I ran Mobile Resource Inspector (MRI) diagnostics as well as Face ID, Camera and Audio Diagnostics, which are required to proceed with any repair.
- Diagnostics detected a hardware failure in the Face ID sensor that cannot be resolved with software solutions.

Condition of Device

- Device contains small gouges and scratches around the edges, considered normal wear and tear.
- All buttons on the device are functional allowing device to turn off and restart for post-repair diagnostics.
- Device is free from cracks that would prevent successful repair completion of camera, front and/or back glass.
- Device is not bent, and cellular antenna has not been affected.
- Device appears to be free of third-party parts that would otherwise cause repair issues.
- Device has a cleaned charging port and device successfully charges allowing wired connection for post-repair diagnostics.

Proposed Resolution

- Because the customer's device does not show any signs of tampering or conditions that would have caused the Face ID sensor to fail, and the device is eligible for warranty coverage, the Face ID sensor can be repaired or replaced at no cost to customer.
- Customer agreed to proceed with a Face ID sensor repair covered under the 1 year Limited Warranty.
- I informed customer that the repair is scheduled for pickup at [2 hours from repair drop-off].
- I informed customer that they will be eligible for [Brand Protection Plan] after repair is completed since they are still within the 1 year Limited Warranty, and their device is in a condition that qualifies for added protection.

- I informed customer that since they are proceeding with a repair, [Brand] is not responsible for any data loss that can occur during repair process as stated in the data waiver form.
- Customer agreed to the terms and conditions, and understands that their data could be lost during repair in which [Brand] is not responsible.
- Customer stated that they have a backup of their data and repair can proceed as scheduled.
- I informed customer that if Face ID sensor repair does not resolve issue, other options will be presented. I inquired customer for alternate contact information should we need them to return before their scheduled pickup time to discuss further options.

Additional Notes

- Customer stated that they would like to add [Brand Protection Plan] to their eligible device after repair is completed. Please partner with Check-In after device is returned to customer so that they can meet with Sales to add protection plan.