

Section I: Learning About PDA Best Practices

Archiving Digital Photographs

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Introduction

Over the course of the twentieth century, photography established itself as a ubiquitous technology in our daily lives. From the introduction of the Kodak brownie camera in 1900 to the invention of the instant polaroid cameras of the 1970s, and then the introduction of digital cameras in the 1990s, photography in all its forms has become one the most popular ways to document our everyday personal histories. Now, thanks to the rising popularity of cell phone cameras, more and more people have a camera with them wherever they go, dramatically increasing the number of photographs we take – a study by InfoTrends projects the number of photographs taken in a year will reach 1.3 trillion by 2017¹

With numbers like these there is a real concern about how we're going to manage and save all of these images for the future. Vint Cerf, chief evangelist at Google, warns of a potential

¹Stephen Heyman.. "Photos, Photos Everywhere." *The New York Times*, July 29, 2015, accessed November 14, 2016, <http://www.nytimes.com/2015/07/23/arts/international/photos-photos-everywhere.html>.

digital dark age², a future where it will be difficult to read historical electronic media because they were left in obsolete or obscure file formats. The sheer amount of photographs now being produced makes older print based archival practices, like hand selecting or keeping everything, impractical. Digital collections are increasingly easy to lose, compared to analogue counterparts. A single computer failure can wipe out an entire digital photograph collection, destroying years of a family's carefully curated memories. There is also the very real danger of accidents happening when migrating data from an old computer to a new one. Another practical concern is how easy it is to lose context for what is shown in photographs: Now that we can no longer sit down and write on the back of a photo it's harder to keep valuable contextual information associated with a photograph. Finally, even with precautions taken against all these hazards, there is still the risk of hardware obsolescence making a collection inaccessible in only ten or twenty years, let alone one hundred.

Role of the Informational Professional

The Library of Congress reports that questions about archiving personal photograph collections are among the most popular ones they receive³. This demonstrates that people are aware of the urgent need for archival work, and that they want to be more involved in archiving their own digital collections. There are also amateur and professional photography communities that have a vested interest in managing and preserving their photograph collections. They have collectively created an extensive body of literature documenting their work to that end. These range from personal websites with extensive blog posts detailing personal systems to the American Society of Media Photographers Digital Photography Best Practices and Workflow, an initiative funded by the Library of Congress.

As such, it's important that the library and archives community knows how to support personal digital archiving processes, and also that we share this knowledge with the general public. The nature of library and archival work equips us professionals with unique perspectives and insights into the preservation of electronic records. It is important that we share this knowledge to raise awareness of the importance of preservation and, hopefully, help more people to start their own personal digital archives before so much material accumulates that they are overwhelmed by the task.

² "Internet Pioneer Warns Our Era Could Become The 'Digital Dark Ages'." *NPR.org*. Accessed September 9, 2016. <http://www.npr.org/sections/thetwo-way/2015/02/13/386000092/internet-pioneer-warns-our-era-could-become-the-digital-dark-ages>.

³ Donald T. Hawkins and Brewster Kahle. 2013. *Personal archiving: preserving our digital heritage*, accessed November 15, 2016, <http://public.eblib.com/choice/publicfullrecord.aspx?p=3316168>.

Simple steps can be taken to help people adopt practices that will help them to better manage their own digital archives. The most important thing in archiving digital photographs is developing a workflow that addresses the capture, organizing and storing of photographs. The chapter will look at best practices in personal photo archiving as well as tools and processes which can be used and implemented to assist in archiving personal digital photograph collections. It is intended as a primer for librarians and archivists to assist their user communities in these tasks.

Common Terms

JPEG (Joint Photographic Experts Group) was a file format developed in the 1980s to handle colour digital images and is the most common format you'll encounter. **JPEG2000** (JP2, JPF, JPX) is a newer (introduced in 2000) version of JPEG which includes a lossless setting.

TIFF (Tag Image File Format) is the U.S. Library of Congress digital preservation standard.

RAW file formats, such as .CRW, .CR2, .NEF and DNG, preserve the original raw sensor data captured by the camera.

Technical metadata refers to the information that is automatically recorded in the file by the camera or scanner, such as the height and width of the image, color space, and image compression. Technical metadata is recorded using the **Exchangeable Images File Format (EXIF)**, which was launched to encourage interoperability between devices and is now recognized as a de facto standard for technical metadata. It is supported by the majority of leading cameras manufacturers.

Descriptive metadata is information that describes the image and is used for discovery and identification. Most descriptive metadata has to be manually inputted using a photo management system. Ideally, descriptive metadata will provide a sense of context, such as who created the image, when and where it was taken, and why. It might even describe the content, like the people or subject matter represented in the image. Essentially, it's very similar to the explanatory notes we used to write on the back of photographs, and can be useful for easily finding and retrieving specific images.

Embedded metadata refers to descriptive metadata that has been embedded using the International Press Telecommunications Council (IPTC) metadata schema and is persistently linked to an image.

Digital Asset Management (DAM) are robust image management systems that allow you to store, organize, search, view, and usually process digital photographs.

Cloud-based photo management and/or storage systems allow you to use the photo management tools, such as organizing, searching and processing of photographs through a web based application since the data and the services are hosted the cloud meaning that files are not stored locally. Examples include Dropbox, Google Drive, or Flickr.

How to Archive Digital Photographs

Planning: What are you going to keep?

The first step in helping someone to set up an archival process starts earlier than most imagine – it is important to start by understanding what is going to be archived. Knowing what they are going to keep, and for what reasons, will help to decide the most appropriate method for archiving their collection. With digital photographs, you will need to help people identify exactly what kinds of images are in their collections and what the patron wants to be able do with them in the future.

Questions you can ask patrons include:

- Are they pictures they took themselves?
- Are they photographs they were sent, or photographs they've digitized?
- Do they want to be able to search and find photographs from specific events?
- Are they planning on passing the photographic collection on to family or friends for safe keeping or do they want to share them right away?
- Are they planning on leaving the collection to an institutional archive?

Starting from an understanding each of these basic uses is important. The process of thinking through what they want to do with their archive will help to create an archival process that is best suited to their needs and capabilities.

The final step in planning is to make sure patrons have the best quality photographs possible. It is difficult to predict what uses will be made of the photographs over a fifty year time frame, and getting the highest quality images at the start of the process, when the picture is first taken, can only help future access and long term preservation. This means taking photographs at the highest resolution possible and choosing the best file format.

What is the best file format?

For preservation purposes, you will want to recommend the use of file formats that have the best chance of being readable in the future. To ensure this, the structure and nature of the format should be openly documented and supported by multiple applications. The three most commonly used are JPEG, TIFF, and RAW file formats, each of which has its own advantages and disadvantages.

For most personal archives, a JPEG file will be the best preservation file format. It's the most common format that is captured by cameras⁴ and is openly documented. It's a relatively lightweight file size, meaning that less storage space is required for archiving images in this format. The major disadvantage to this format is that JPEG uses lossy data compression, meaning it reduces the file size of an image by merging similar or "redundant" pixels, so less information is kept overall. For most people and most use cases, however, this is not a significant issue. JPEG2000 is not widely supported or used. This makes it a poor choice for preservation.

While TIFF is a proprietary file format, it is well documented and broadly supported. It is a lossless image format, and a good choice for people who are looking to preserve the highest possible image quality. The major disadvantage of this format is that TIFFs generally result in very large file sizes for only a small gain of image quality. It is therefore the best choice for professionals, but not necessarily for the rest of us.

RAW file formats can be compared to a digital negative, since it contains all the information used to render a digital image. Working with RAW files is more difficult – they are read-only files that require additional software to access and edit. With the exception of DNG, they are all proprietary formats specific to certain camera models; DNG is openly documented and supported by Adobe. In almost all cases, RAW files are not appropriate for personal photographic archives. They should only be used in the rare cases where there is a need to make substantial edits in the future that require all of the information captured in this format.

Consolidating: Where are all the photographs?

Before creating an archive with someone, it is important to gather all their photographs into one place. When working with people, you will likely find that this is the first big hurdle you encounter, but it can be overcome with careful planning.

First, identify all the image sources being used. This includes all the devices that both they and their families are using to take photographs, such as cell phones and cameras, and also

⁴ Most common file format identified in the 'InterPARES survey of record keeping practices of photographers using digital technology' as cited in Bushey, J. 2008. "He Shoots, He Stores: New Photographic Practice in the Digital Age." *Archivaria*, no. 65: 125–50.

any printed photographs that they have already or will be scanning. When it comes to cell phones, it is important to understand where photographs are stored in order to ensure they are all transferred. The camera function inside an application, such as Facebook or Instagram, for example, may not store photographs in the same place as the native camera application.

The goal at this stage is to make sure that all their photographs are all stored in the same location on their computer. This principle is often referred to as the 'Rule of One.' This location contains the master versions of a user's photographs, and is used as the source for all backup copies.

Regularly transferring photographs to the master location is critical, given the vulnerability of portable devices such as smartphones and cameras to theft, loss, or damage. Encourage people to get into the habit of transferring photographs from portable devices to their computer on a regular basis. The simplest method is to use the default software that comes with their camera or their phone. Another option is to use photo management software, which we'll talk more about in the section on organizing photographs.

The next step is equivalent to the archival appraisal process; it involves selecting what to keep and what to discard. Although it may seem simple enough to just keep everything, **encourage people not to ignore this step.** A smaller photograph collection is significantly easier to organize and maintain, and makes it much easier to find specific photographs. If someone you are helping is hesitant to do this, you can remind them that the price of film and of having photographs printed used to limit the number of photographs we took. There used to be a selection process that happened before we even took a picture, and that helped to keep the number of photographs in our collections under control. In addition to these usability concerns, there are also technical advantages to smaller collections. The larger the collection, the greater the risk of file corruption when migrating the collection to new storage media.

File naming best practices

This is also a good time to suggest thinking about the naming of files, and how this can help with preservation and access. A good file naming system should be easy to communicate and self-evident when looking through files.

[sidebar] File naming tips

- Ensure that your file names are unique. Your photo or camera will typically assign filenames using sequential numbering but these will eventually be repeated. Adding something before or after the file names when transferring images to your computer will help prevent duplicate file names.

- Adding meaningful and descriptive filenames will help you browse and search for photographs. Adding a level of description in the filename also allows you take advantage of the sorting capabilities of built in file systems.
- Be concise: Long file names can cause issues in the future with migrations between media and computers.
- Avoid complex or illegal characters. Avoid using blank spaces, capital letters and special characters in your filenames because certain computers have trouble reading them and they can cause problems when moving files between computing environments.

Renaming files individually isn't practical but when transferring files to a computer, there is often an option to add a prefix to the file names of all the photographs being transferred. This can help designate an event (such as a birthday or a holiday), a location or a date.

Organizing: Putting things in order

Once you've helped someone gather all their photographs in the same place, they will need to have a system to organize them. There are any number of ways to organize photographs and choosing between them comes down to what works best for the owner of the collection. Identifying what they want to do with the archive will make it easier to decide how to best organize their collection. Like file naming, the best organization method is one that is consistent, self-evident, and expandable. A good place to start is using the default structure that is created when photographs are downloaded from the camera to the computer. Often these programs will automatically organize photographs using embedded technical metadata, such as creation date. Using this structure as a base, you can create sub-directories based on other meaningful information, such as subject or event.

Software

The easiest way to organize and manage a digital photograph collection is to use photo management software. Common features of these programs include: generating thumbnails previews, organizing images into folders or collections and creating basic metadata. Most of these programs also support simple editing, emailing and exporting of photographs.

Photo management

The first category of software is the built in photo management applications that come with most computers, such as Apple's Image Capture, iPhoto/Photos⁵, and Windows Explorer Gallery. All of these provide good, basic infrastructure to be able to browse images and add

⁵ iPhoto was replaced with Photos in OS X 10.10.3, on April 8, 2015. Nathan, Ingraham. 2014. "Apple Stopping Development of Aperture and iPhoto for OS X." *The Verge*. June 27. Accessed November 11, 2016. <http://www.theverge.com/2014/6/27/5849756/apple-stopping-development-of-aperture-and-iphoto-for-osx>.

basic file level metadata, such as descriptions and tags. In addition, Apple Photos supports the recognition of 'Faces', where you can identify people appearing in your photographs,^[6] and reads embedded GPS location data if available.

A free and popular photograph management alternative is Google Photos. This application is the replacement for their popular desktop application Picasa, which was officially retired in March 2016. Like iPhoto/Photos, it supports adding descriptions, tagging people in photographs and reading embedded GPS location data. Other software options include XnView MP and FastStone.

[Side bar] One small point of concern with Apple's iPhoto/Photos application is that it automatically creates a separate file library to store all of your photographs, which makes it difficult to locate individual files on your hard drive. This makes it more complicated to create backups and migrate user data. Apple is also pushing the integration of the Photos software with iCloud photo sharing and warns about possible syncing issues if you store your library on online storage services, such as Dropbox or Google drive. This is contributing to an increasingly closed and proprietary computing environment, which makes it more difficult to implement good archival practices.

Digital asset management

Digital asset management programs represent the next level up in terms of features and complexity. These are robust applications with extensive photo editing and processing features and excellent support for standards-based descriptive metadata. There is a great deal of information available online about how to use them to effectively organize photography collections. They are commonly used by advanced amateurs and professional photographers. Popular examples of these programs include Adobe Bridge, Adobe Lightroom, and Extensis Portfolio.

Cloud-based photo management

A new trend is to use specialized web-based applications to organize and store photographic collections. These include the previously mentioned Google Photos and iCloud photo storage. There are also photo exclusive sites, like Shutterfly, SmugMug, Mylio, and Flickr that let users upload and archive an unlimited number of photographs for either free or small fees. One thing to note when using cloud based programs to organize and store your photographs is that these require a fast and stable internet connection in order to operate effectively.

For people who use these programs, it's strongly recommended that you maintain an additional backup of your files. A number of these companies, such as 1000memories and PictureLife, have disappeared over the past few years, taking their users' photographs with

them. The sudden closure of PictureLife and the attempts of users to get their photographs back was documented in an episode of Reply All podcast⁶. Their difficulties are a powerful example of some of the issues with web based organization solutions.

[sidebar] How to choose the best tools?

Since software changes so rapidly it's tricky to recommend specific software or online tools. It's better to communicate how to evaluate the tools out there. Some good questions to ask include:

1. **Sustainability:** Is the tool you are using proprietary or open source? Just like file formats, we want to encourage people to use open and well documented tools to account for future obsolescence.
2. **Cost:** Is it free or is it a paid service? Is it a one-time payment for software or is it subscription? Many have a free account with limited storage that is useful to try out software. If you pay for the service, what happens to your photographs if you miss a payment?
3. **Security:** Does the service offer secure storage and transfer? How secure? If you use cloud storage do you know what security measures/encryption they use to keep your photographs safe?
4. **Exporting your photographs:** How easy is it to retrieve your photographs from the service? If you want to change software, can you easily migrate your photographs? What if the tool disappears, are the photographs still retrievable? If you pass away, can designated people retrieve the photographs and associated metadata?
5. **Metadata:** If you use the software to add metadata, where is it stored? If you stop using the software will you lose all your labels or tags? When you export your photographs is the metadata exported with them? Does the tool change the metadata in your photographs? For example, when you upload a photo to Facebook it changes the embedded creation date to the date you uploaded the photo. Even if you are only uploading copies of your photographs, changing the metadata can create confusion later on.

Describing: Adding context and information

Ensuring a photograph has accurate and thorough metadata is critical to preservation. Without good metadata, even if a photograph is saved in an archive it may not be possible to actually find it again, and that defeats the purpose of having an archive in the first place. During the process of creation, both technical and descriptive metadata can be attached to and embedded in the photograph, and additional descriptive metadata can be added.

⁶ #71 The Picture Taker." 2016. *Reply All:Gimlet Media*. Accessed November 22. <https://gimletmedia.com/episode/71-the-picture-taker/>.

Technical metadata refers to the information that is automatically recorded in the file by the camera and you can see this information by clicking on the "File Information" option in most computer file management systems.

Descriptive metadata is information that describes the image and is used for discovery and identification.

While the value of metadata is high it also takes a lot of work to create. While it's possible to be overwhelmed by the act of describing each photograph, it's important to emphasize that simple things, like adding event names at the start of file names or creating simple captions, can have a huge benefit and be of great help for finding photographs again in the future.

Embedded metadata

Embedded metadata refers to descriptive metadata that has been embedded using the International Press Telecommunications Council (IPTC) metadata schema and is persistently linked to an image. Since its release in 1991 IPTC has been the defacto standard to transfer information and includes extensive fields to capture granular information such as the photographer's name, contact information and copyright statement. Upgraded in 2011 the schema is now based on Adobe's Extensible Metadata Platform (XMP) framework⁷ and is compatible with Extensible Markup Language (XML). It is an open format, supported by both Adobe products and over 70 other programs⁸. An advantage of using widely available image file formats, such as JPEG and TIFF as opposed to proprietary RAW files, is that they support embedding metadata into the image file.

Adding metadata

The simplest way to embed information into the file is to select a file on any computer (Mac or PC) and then select File > Get Info, where you will find a text field that you can write comments in, much like the back of a photograph. One thing to note is that field names and terminology, such as 'caption' and 'description', are sometimes different from program to program.

Photography professionals routinely use photo editing software to add metadata to their digital photos for copyright and business reasons. Most of the photo management systems that we talked about in the organizing section also have the ability to add descriptions and other information to a photograph.

⁷ as per <https://iptc.org/standards/photo-metadata/iptc-standard/> Accessed on November 11, 2016.

⁸ as per http://www.w3schools.com/xml/xml_what_is.asp Accessed on November 11, 2016.

Another advantage of adding description that are embedded is that it can be read by websites when you want to publish and share photographs online. For example, both Flickr and Facebook read embedded descriptions and display them as a caption when you post. Unfortunately, this is still not very standardized. The Embedded Metadata Manifesto initiative created by the International Press Telecommunications Council and supported by a number of other photography associations has been doing tests to determine which online services read the metadata and preserve it in the file when downloaded.^[9]

Storing: Where should you keep all the files?

After helping someone to consolidate and organize all of their files, it is vitally important to then help them to set up a system to back up their photographs. The reality is that computer hard disks fail, and files can be lost in natural disasters, or as a result of a power surge or theft. Without a backup, any of those scenarios would mean they would lose all of their photographs - and it would not take much effort to prevent this with backups.

How many backups should you encourage someone to have? A popular recommendation is the 3-2-1 approach. This means recommending keeping three complete copies of all files, with at least one copy at an off-site location. In my personal archive I have a system where I regularly copy my photos to my computer master folder (first copy). Once a month or so I'll make a copy of the entire photo folder from my computer onto a portable hard drive (second copy), and I use a program to run nightly cloud backups automatically (the third copy, at an off-site location). Instead of using cloud storage, you can recommend storing an external hard drive offsite, like at a relative's home or in a safety deposit box. This off-site copy is critical in the event of catastrophe (flood, fire) that could destroy any locally stored backups. Even in that worst-case scenario, the photographic archive would survive.

How do you create a backup?

Backups can be tedious and time consuming to make. Using software to automate the process can be extremely helpful. Backup software makes it easy to synchronize selected files on a storage system separate from your main hard drive, and then replicate file changes when they occur. Most backup software can schedule regular scans of a hard drive for new and changed files on daily, weekly or monthly basis, or the software can continually monitor the computer for changed or new files. It is likely to take a long time to perform the first synchronization, since all the data in the archive has to be read and copied. After that first sync only the differences in the data are synchronized, which makes for a much quicker process.

While this makes backups easier, it also means that any changes made to the master files will almost immediately be made to the backup as well, since the files are mirrored. This

means that the backup files are as vulnerable to accidental changes and deletions as the master files. Examples of local backup software include GoodSync and Chronosync.

You should also be able to recommend appropriate storage media. An external solid state drive is a good option; they are easy to use, inexpensive and provide sufficient capacity for many people. An external drive used for backup should be used exclusively for backups and stored in a safe, secure place. It should not be used to transport files. This minimizes the possibility of damage to the drive and data loss. If you need to recommend more storage than an external drive provides, consider suggesting a NAS device (network attached storage), which is a small computer with a lot of storage capacity designed to operate as an appliance for storing and sharing files over a network. It is a more advanced and more flexible option, but also more expensive. CD-Rs or DVD-Rs are not recommended for backing up photographic collections. The transfer time is more time consuming and the limited capacity of these media may result in splitting data over several disks.

Cloud-based storage options

There are a number of cloud-based storage options, where storage is provided by a commercial data center. The obvious advantage of storing photos in the cloud is that they are accessible from anywhere. Like all internet services, they require a high speed connection and a large data allotment to make them practical options. This is a real concern when thinking of the digital divide and rural communities. As with cloud-based photo management applications, you also need to be aware of security and longevity issues, and the same questions about choosing the best tool apply here. Some examples of online backup services that backup your data to the cloud include CrashPlan, Mozy, and Backblaze.

When looking at and evaluating cloud-based tools, there are differences between the ones that focus on general storage and the ones that are geared towards photography. General cloud storage sites not only offer folder and file syncing, but also media-playing and device syncing. Examples of these are Apple's iCloud, Google Drive, Microsoft OneDrive and Dropbox. Photography specific sites such as Flickr and Google Photo support only image and video files, but include more storage and provide more features, such as built-in editing and management tools. For example, Flickr offers 1TB of free storage and SmugMug, which is aimed at professional photographers, has unlimited storage for \$40 a year.

[sidebar note] Refreshing Archival Data

All current storage media (CDs, DVDs, memory keys, HDs) have a shelf life and will eventually fail due to physical degradation. In any archival system the data must be migrated to new storage media on a regular basis. That means checking the integrity of your archival storage and replacing your archival storage media with new media at regular

intervals (every 5 to 10 years). One type of archival media that should not be forgotten is printing photos. Properly produced and cared for, printed images can last for hundreds of years—much longer than contemporary digital storage media.

Conclusion

While this chapter presents the archival process as a neat chronology I would argue it doesn't all need to be done in order. If someone is overwhelmed by a hard drive that feels like it is overflowing with photographs--and anecdotal evidence suggests that many people are in this position!--then we can start by helping them get all of their photographs in the same place and then backed up. From there, encouraging them to commit to regularly transferring their photographs to their computer and then to subscribe to a cloud backup service can have a huge impact with only minimal effort. After that, the conversations about deleting photographs and planning can happen more calmly. When their collection has been slimmed down to a more manageable size, introduce the concepts behind describing key moments and identifying people, and how this can help to better organize their collection. Finally, look into current software with them and offer advice on what tools they can use to support their archiving process. If enough people adopt these best practices, it will have a profound impact on the quality and quantity of our future visual historical record.

Preserving the growing number of digital photographs being produced is a growing concern shared by the public, photographers, and cultural institutions alike. Recently, we've started to see a paradigm shift, where preservation and archiving is being recognized as something that needs to start with the creator, at the beginning of their workflow when a photograph is first taken. Institutionally, we can take a number of useful steps: we can encourage the standardization of procedures for creating, managing and storing born digital images, we can support the development of image metadata to further improve existing profiles, and we can foster the development of open and non-proprietary technologies. But our work depends on creators adopting these best practices and implementing them in their own personal photograph collections. The work of preserving our prolific photographic output for the historical record depends on all of us.

Further Resources

The **Library of Congress website** is a good resource for accessible introductions to the topic of personal digital archiving.

- The section on archiving digital photographs give a good simple overview that can be shared with non-specialist:
<http://www.digitalpreservation.gov/personalarchiving/photos.html>
- They also have some excellent videos.
 - An overview of scanning photographs:
<http://www.digitalpreservation.gov/multimedia/videos/scanner.html>
 - How to add descriptions to your digital photographs:
<http://www.digitalpreservation.gov/multimedia/videos/personalarchiving-photometadata.html>
- The Signal, the Library of Congress blog on digital preservation, has a category for Personal Digital Archiving which is good up to date source on many issues:
<https://blogs.loc.gov/thesignal/category/personal-archiving/> . Notable posts on archiving digital photographs include:
 - Ashenfelder, Mike. 2011. "Adding Descriptions to Digital Photos | The Signal." Webpage. October 28. <https://blogs.loc.gov/thesignal/2011/10/mission-possible-an-easy-way-to-add-descriptions-to-digital-photos/>.
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 - Manus, Susan. 2011. "Photo Sharing Sites as Digital Preservation Tools | The Signal." Webpage. November 2. <https://blogs.loc.gov/thesignal/2011/11/photo-sharing-sites-as-digital-preservation-tools/>
- *Perspectives on Personal Digital Archiving* is an ebook that is a compilation of some of the best posts from the Signal blog:
http://www.digitalpreservation.gov/documents/ebookpdf_march18.pdf

For a more in depth introduction I would recommend reading the Digital Preservation Coalition report on Personal Digital Archiving. While there is no specific section dedicated to photographs it has many good advice and resources that are applicable.

- Gabriela, Redwine. n.d. "Personal Digital Archiving." *DPC Technology Watch Report*.
<http://dx.doi.org/10.7207/twr15-01>

For more in depth information and resources on image management and metadata <http://controlledvocabulary.com/> is maintained by David Riecks, who has been a featured speaker at number of image management and archiving conferences and webinars.

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