Master's Thesis Outline

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1. Introduction
   (a) Motivate the need for digital media forensics.
      i. Explain why determining authenticity is important.
      ii. Explain how easy it is to make forgeries (especially of the frame deletion kind).
      iii. Show that tools need to be developed to tackle these problems, since we cannot tell by inspection.
   (b) Sample various topics in digital media forensics.
      i. Source Identification
      ii. Forgery Detection
   (c) Drill down into the problem of video tampering.
      i. Explain that removing frames from video can change context (news media).
      ii. Explain that there is a previous body of research that attempted to solve this problem.
         A. The research was done on MPEG-2 video.
         B. Since the research was done, most videos recorded use more advanced encoding.
         C. The methods used previously may not work anymore, and if they do, they are now suboptimal.
   (d) Explain my proposed solution and motivate the topic of the thesis.
2. Related Work/Background
   (a) Subsection: Video Encoding
      i. Talk about video encoding basics. Particularly that of MPEG-2.
   (b) Subsection: Prior Frame Deletion Detection Research
      i. Talk about work done on MPEG-2.
         A. Wang and Farid's paper.
         B. Dr. Stamm's paper.
         C. Other work done. Find papers that cite Farid's original.
   (c) Mauro Barni's Paper
   (d) Brief mention of why prior research doesn't solve the problem.
   (e) Lightly Motivate Problem
3. Problem Formulation
   (a) Why do we need a new frame deletion detection algorithm?
      i. Limitations in assumptions made in Farid's and Stamm's papers
      ii. Link definition of fingerprint signal to why it might not work in H.264.
      iii. It is not obvious that these previous methods will work in H.264.
   (b) Subsection: Frame/segment deletion traces.
   (c) Subsection: Frame/segment deletion detection.

i. Set up as a classification problem.

(d) Elaborate assumptions of double compression.

(e) Assumptions of deletion from beginning of video.

(f) Assumptions of number of frames deleted (may not be necessary depending on dataset used).

(g) Explain mathematical definition of fingerprint signal.

4. Proposed Approach

   (a) Subsection: Prediction Error Sequence Extraction.
      i. Say how prediction error sequence was extracted in prior work
      ii. show experiment demonstrating that frame deletion detection fails when this old sequence is used with H.264
      iii. Describe how *you* propose extracting prediction error sequence.

   (b) Subsection: Proposed Detection Algorithm
      i. Why you do it.
      ii. What you do.
      iii. Rationale for additional detection features.
      iv. Rationale for AR modeling.

5. Experimental Results

   (a) One camera model.
      i. Basic Accuracy for all methods.
      ii. Accuracy if Reencode GOP doesn't match original.
      iii. Accuracy for varying numbers of frames deleted.
      iv. Accuracy for uniformly selected numbers of frames deleted.

   (b) Multiple Camera Models.
      i. Basic Accuracy for all methods (Reencode GOP matches original GOP for each camera).
      ii. Accuracy as number of camera models in training set are increased, testing on an unknown camera.
      iii. Accuracy as number of frames deleted from each camera's set is different.
      iv. Accuracy vs number of frames in a sequence in a video.

6. Conclusion