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Face Recognition Systems Operation Assurance: Preserving Image Quality in Desktop Documents

32

33 **1. Scope**

34   1.1 The scope of this document is to provide a detailed process and examples of

35 how image quality can be maintained if applications such as Microsoft Word or Adobe

36 Acrobat are used to store facial images, that may then be enrolled or searched in

37 automated face recognition systems (FRS). If these processes are not properly

38 managed, then image quality will be reduced which can then lower the accuracy of the

39 FRS.

40   1.2 The file formats this document will utilize are Microsoft Word in Microsoft Office

41 version 2016 which uses the file extension of ".docx". Additional Office 2016

42 components this document applies to include Excel (".xlsx") and PowerPoint (".pptx").

43 This document does not cover previous versions of Microsoft Office or other desktop

44 suites which manage these types of documents.

45   1.3 Many Internet resources are available which detail the file formats used in

46 Microsoft Office documents [1].

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47   1.4 Agency system administrators should be consulted regarding image extraction

48   usage so proper computer security issues can be addressed. If the processes in this

49   document are used, it is recommended to not convert the Office documents to a PDF

50   file format as this conversion appears to lower the quality of the images in the resultant

51   PDF file.

52   **2.   Referenced Documents**

53   2.1 *ASTM Standards*: [1]

54   E2916 Terminology for Digital and Multimedia Evidence Examination

55   E2825 Standard Guide for Forensic Digital Image Processing

56   2.2 *Other Standards:*

57   Microsoft Office file formats[2]

58   NIST Multiple Encounter Dataset (MEDS)[3] https://www.nist.gov/itl/iad/image-

59   group/special-database-32-multiple-encounter-dataset-meds

60   **3. Terminology**

61   3.1 *Definitions:*

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[1] For referenced ASTM standards, visit www.nist.gov/osac/astm-launch-code, or the ASTM website, www.astm.org, or contact ASTM Customer Service at service@asstm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.
[2] Microsoft technical documentation, including file formats, is available from https://docs.microsoft.com/en-us/#office or https://microsoft.com.
[3] Available from National Institute of Standards and Technology (NIST) website https://www.nist.gov/itl/iad/image-group/special-database-32-multiple-encounter-dataset-meds or http://www.nist.gov.

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62   3.1.1 See ASTM E2916 Terminology for digital and multimedia evidence

63   examination terms.

64   3.2 *Acronyms*

65   3.2.1 *PPI*–Pixels per inch measurement of the pixel density of an electronic image,

66   or of a device such as a computer monitor or camera. For example, a 1200 PPI image

67   will display higher quality detail than a 300 PPI image. Use of PPI as a resolution term is

68   generally used with digitally captured images (i.e., photography).

69   **4. Summary of Guide**

70   4.1 This document provides guidelines and techniques to help administrators of

71   automated face recognition systems ensure image quality is maintained when facial

72   images are inserted into desktop documents for storage or submitting to agencies for

73   enrolling or searching with face recognition systems.

74   4.2 The intended audience of this document is system owners, system users, and

75   system administrators of existing automated face recognition systems.

76   **5. Significance and Use**

77   5.1 Introduction

78   5.1.1 Attention to ensuring and preserving image quality in facial images presented

79   to an FRS for enrollment or searching is critical achieving the best possible accuracy. It

80   is always recommended to transfer facial images in their original file format without

81   alterations. However, there are instances where documents are used store images, and

82   then transfer the images from a point of origin to the FRS agency. When documents

83   are used there are simple steps which can be done to preserve image quality.

84   5.1.2 This document covers the following areas:

85   • How to modify Microsoft Office components (e.g., Word, Excel, PowerPoint)

86   to preserve maximum image quality when inserting facial imagery

87   • Examples of how image quality is reduced when Microsoft Office is not setup

88   to maximize image quality

89   5.2 Data Set

90   5.2.1 Facial imagery from the NIST Multiple Encounter Dataset (MEDS) was used

91   in this document [2].

> **NIST Special Database 32** - Multiple Encounter Dataset (MEDS) is a test corpus organized from an extract of submissions of deceased persons with prior multiple encounters. MEDS is provided to assist the FBI and partner organizations refine tools, techniques, and procedures for face recognition as it supports Next Generation Identification (NGI), forensic comparison, training, and analysis, and face image conformance and inter-agency exchange standards. The MITRE Corporation (MITRE) prepared MEDS in the FBI Data Analysis Support Laboratory (DASL) with support from the FBI Biometric Center of Excellence.
>
> **Acknowledgement**
> This dataset is being released (as prepared by MITRE Corporation) to support the NIST Multiple-Biometric Evaluation 2010 (MBE). In addition, this dataset is available to any user interested in biometric research. The sponsor of this joint effort and provider of the data is the Federal Bureau of Investigation (FBI).

92   5.2.2 Ten images from MEDS were randomly selected based on image size. For

93   these images, facial issues such as lighting or pose were not considered since the goal

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94   of this document was to investigate image size variations from the point of document

95   insertion to image extraction.

96

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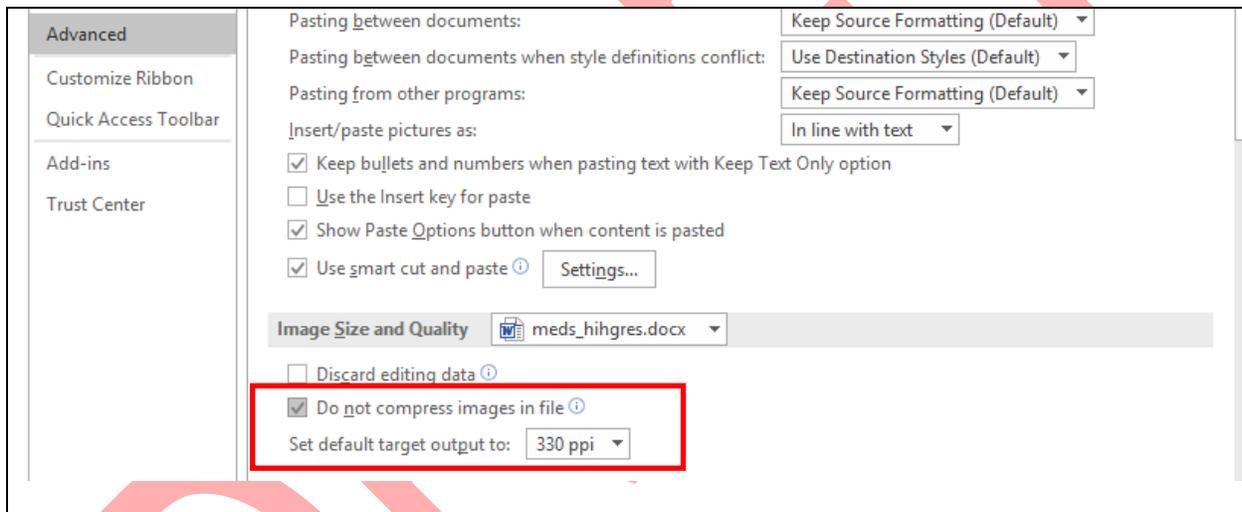
97 **6. Procedure**

98   6.1 Image Insertion Process

99   6.1.1   Step 1: Open Word from Microsoft Office 2016

100   6.1.2   Step 2: Select Home->Options->Advanced. Then locate "Image Size and

101 Quality." Select:

102   • "Do not compress images in file"

103   • Set "Set default target output file to:" 330 ppi

Figure 2: Image Quality Settings

105   Note that Excel and PowerPoint 2016 have the same options.

106   6.1.3   Step 3: Insert the images into the document and save the document to disk.

107   6.1.4   Step 4: The user will see that final file size of the .docx will be larger since

108 the facial images will not be compressed.

109   6.1.5 Examples:

File	File size on disk
Raw images not inserted into the document	1,728 KB
Docx: No compression	1,815 KB
Docx: 300 PPI	1,814 KB
Docx: 220 PPI	1,329 KB
Docx: 96 PPI	402 KB

110   **Figure 3: Office Document File Size Comparison**

111   Looking at a single image inserted and extracted as an example:

File	File size	rows	cols	channels	ppi	format	SHA1
Original file inserted	469949	2000	3008	3	(300 300)	RGB	6CDAEDACA97FFF66FF6D 3EC75CDA1BBB1740B759
Docx: No compression document	469949	2000	3008	3	(300 300)	RGB	6CDAEDACA97FFF66FF6D 3EC75CDA1BBB1740B759
Docx: 330 ppi resolution document	469949	2000	3008	3	(300 300)	RGB	6CDAEDACA97FFF66FF6D 3EC75CDA1BBB1740B759
Docx: 200 ppi resolution document	216668	924	1390	3	(220 220)	RGB	531152964A71D4D8A3B453 F3D5CE8C2953F3CDC0
Docx: 96 ppi resolution document	16400	404	608	3	(96 96)	RGB	A9E8A46E28BEAF9E3275F DD1BC81B50511FCB5E0

112   **Figure 4: File Comparison**

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113   6.2 Observations**:**

114   • The original image was extracted from the "No Compression" and 330 ppi

115   documents as evidenced by the identical SHA1 checksum (<mark>yellow highlight</mark>)

116   • As the Word image quality resolution is reduced from "No Compression" to 96

117   ppi the inserted image file is reduced in size with a corresponding reduction in
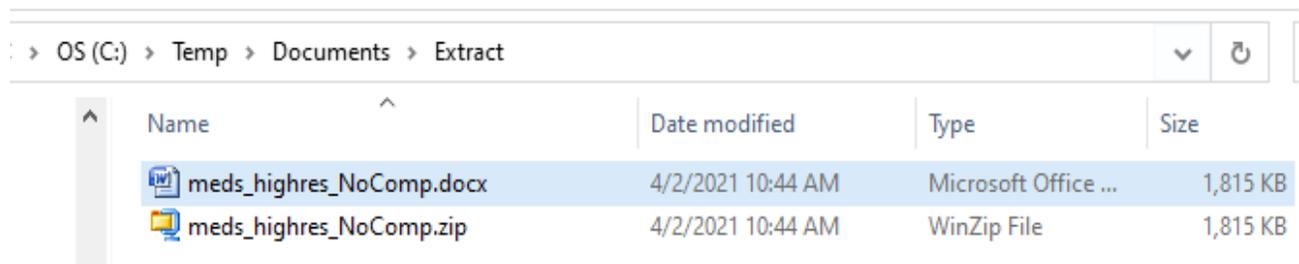
118   image quality

Original Image	

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| 96 ppi | |
| image | |
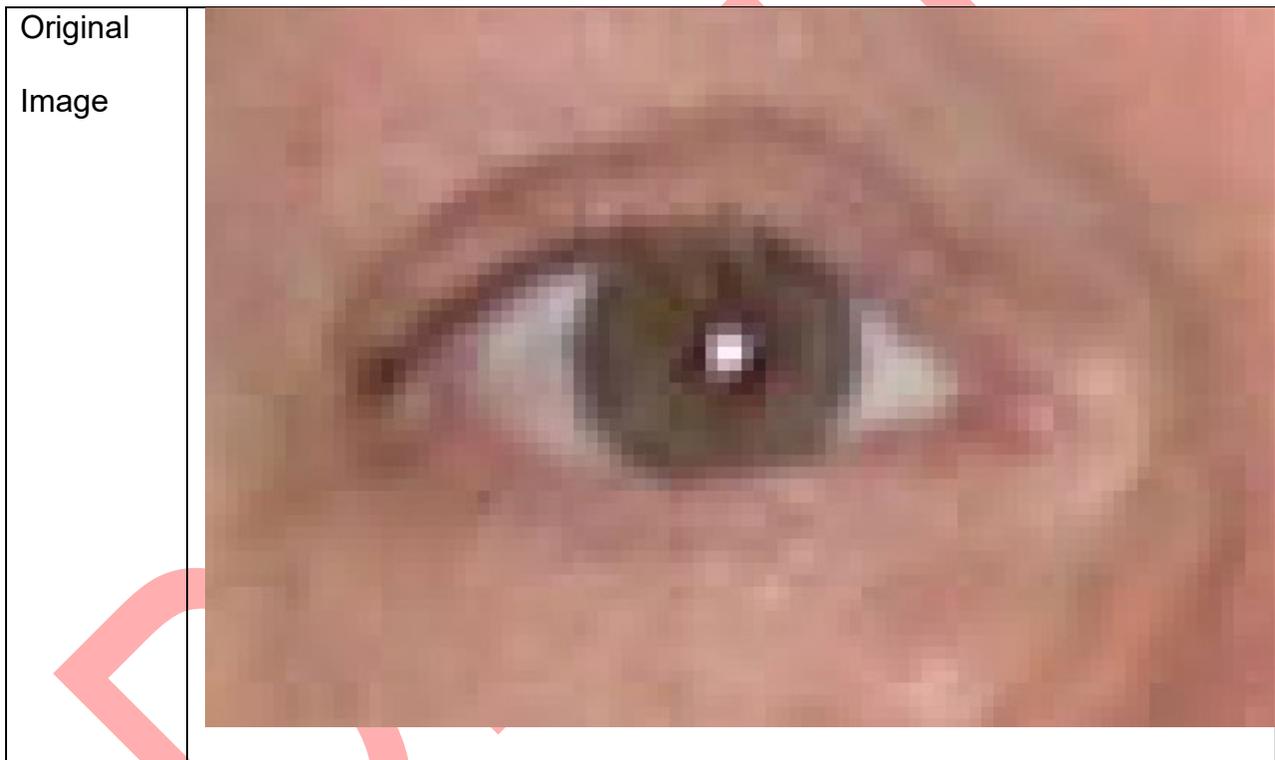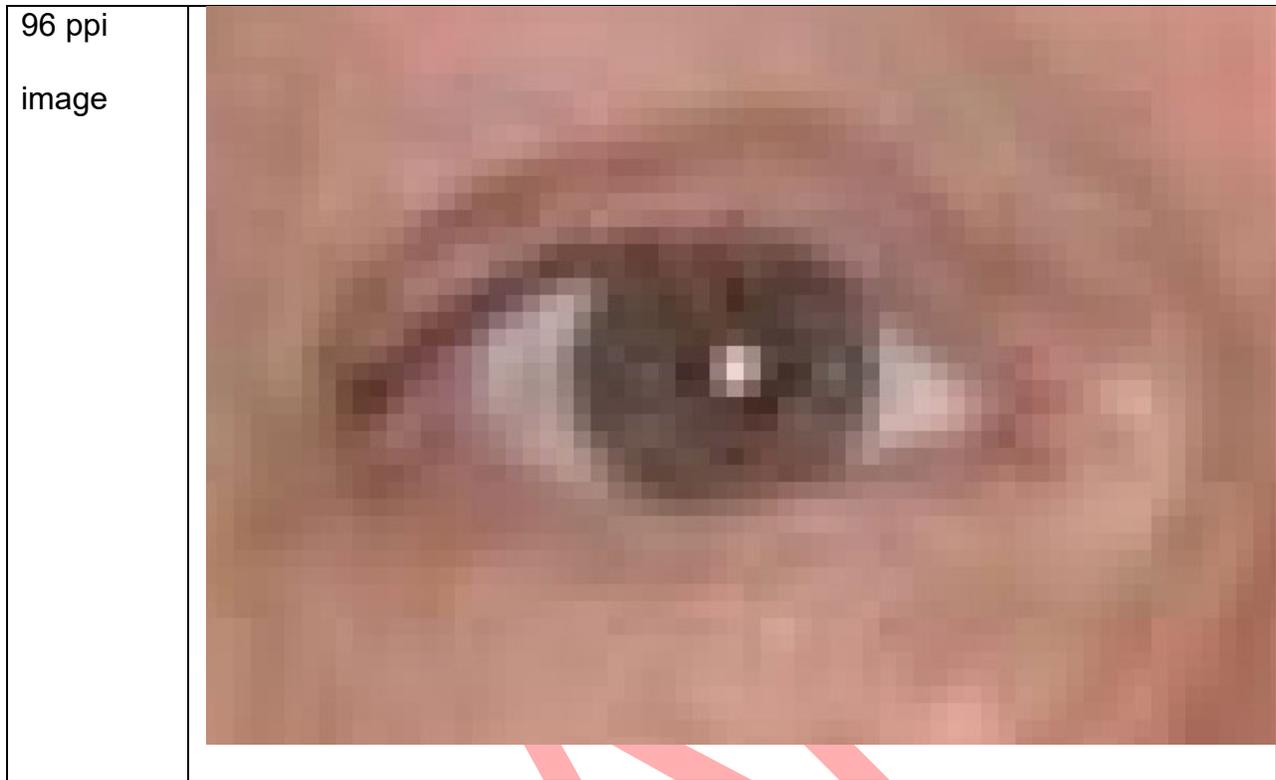
Figure 5: Image Comparison

119
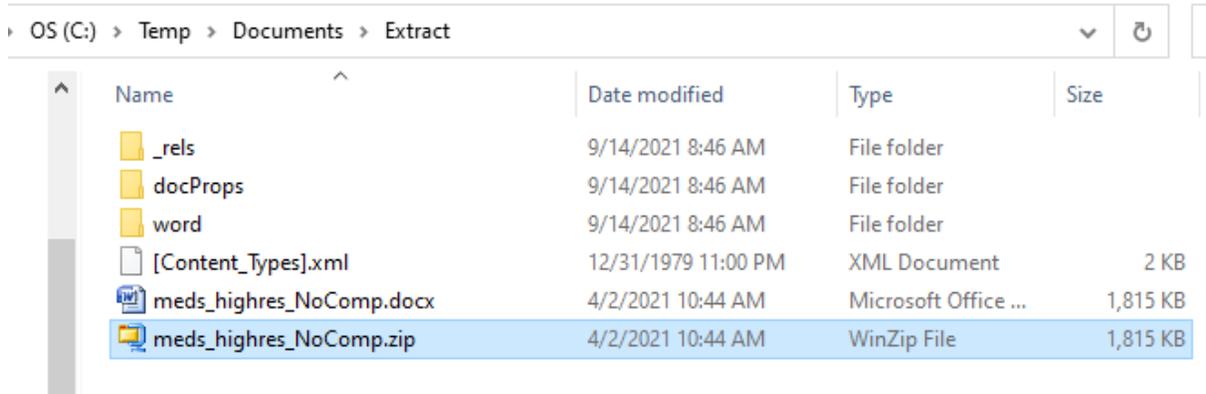
120   6.3 Image Extraction Process

121   6.3.1 **Step 1:** Copy the document to a temporary directory
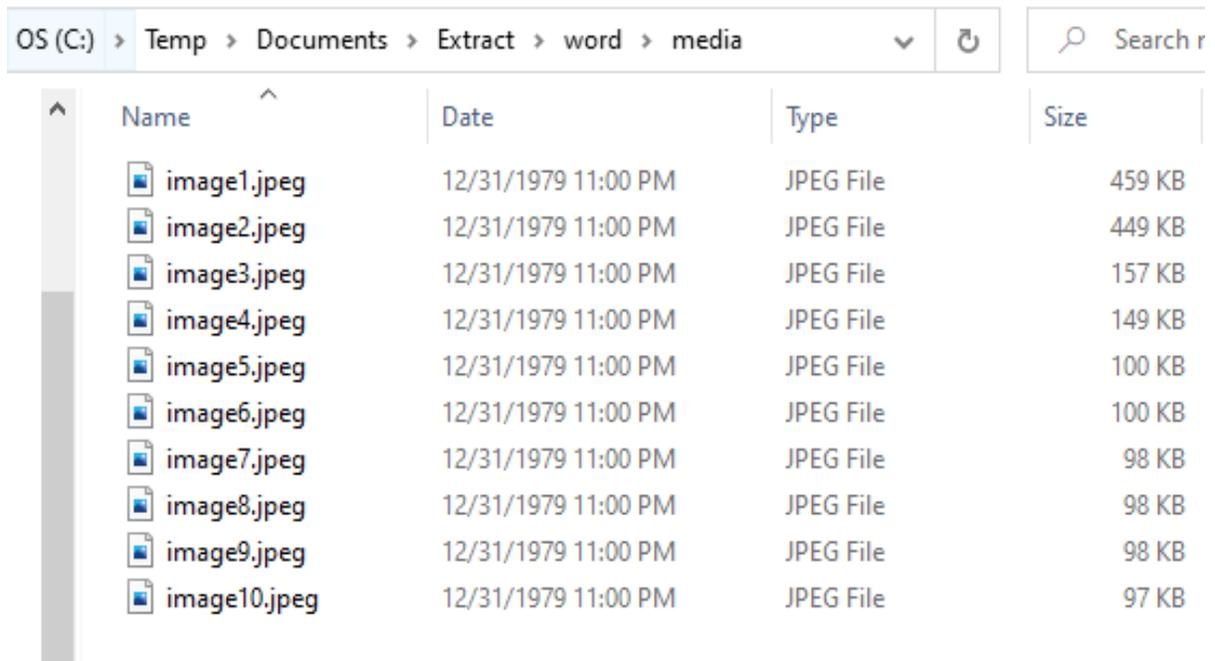
122   6.3.2 **Step 2:** Rename the .docx file to .zip

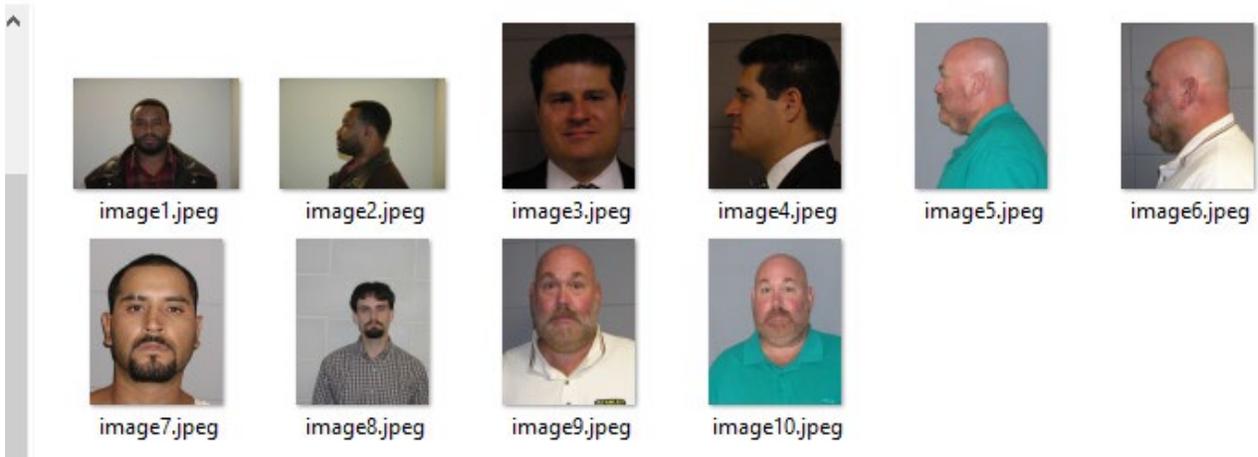124   6.3.3 **Step 3:** Extract the zip file to disk

126   6.3.4   **Step 4:** Go to the directory "word\media" to see the images

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129   6.4 Outcomes

130   6.4.1   When inserting facial images into desktop documents the processes in this

131   FISWG document present:

132   • How to adjust Microsoft Office Word 2016 (.docx) to maximize image

133   quality when inserting facial images. These adjustments also apply to

134   Excel and PowerPoint (.xlsx and .pptx).

135   • If Word 2016 is properly adjusted before inserting images, the images

136   extracted are the same images as inserted into Word, thus preserving

137   image quality as proven by the identical SHA1 checksums.

138   • This process should work with any image format inserted into Office 2016

139   (e.g., bmp, png, etc.) but agencies who utilize this technique should verify

140   the process works as intended with their own images before deploying this

141   as a standard operating procedure.

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144   FISWG documents can be found at: www.fiswg.org