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COLOR FACE SUPER-RESOLUTION RECONSTRUCTION WITH HIGHER-ORDER
SINGULAR VALUE DECOMPOSITION



Mr. Krissada Asavaskulkeit

A Dissertation Submitted in Partial Fulfillment of the Requirements
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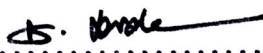
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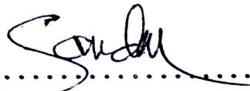
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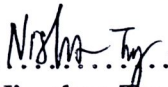
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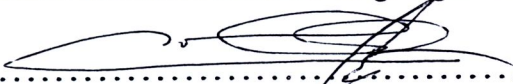
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วิทยานิพนธ์ฉบับนี้เสนอการสร้างคืนเทนเซอร์ภาพสีหน้าคนความละเอียดสูงยิ่งด้วย
 การแยกค่าเอกฐานอันดับสูงบนพื้นฐานของระบบสีทั้ง 4 แบบได้แก่ ระบบสี RGB , ระบบสี
 YCbCr , ระบบสี HSV และระบบสี CIELAB จำนวน 2 วิธี วิธีแรกนั้นอาศัยแบบจำลองถดถอย
 ร่วมกับ MPCA เนื่องจากภาพสีหน้าคนจะมีลักษณะที่เหมาะสมกับข้อมูลในปริภูมิเทนเซอร์

เราพบว่าในวิธีดั้งเดิมที่เคยมีการนำเสนอ นั้น ไม่ได้คำนึงถึงความสัมพันธ์ของข้อมูลใน
 แต่ละช่องสัญญาณสี ดังนั้นกระบวนการสร้างคืนภาพมีความผิดพลาดเกิดขึ้น ซึ่งถ้าอาศัยวิธี
 ที่เรานำเสนอในวิทยานิพนธ์ฉบับนี้ในแง่ของการ พิจารณาผลกระทบของค่าลักษณะเฉพาะ ,
 สัญญาณรบกวน , จำนวนภาพเทรนนิ่งและความซับซ้อนของอัลกอริทึม พบว่าเราจะสามารถ
 สร้างภาพคืนความละเอียดสูงยิ่งได้ใกล้เคียงกับภาพต้นฉบับ

ในส่วนของวิธีที่สอง ที่เรานำเสนอ นั้น เราจะนำ ภาพหน้าคนที่ เป็นภาพสี คู่ความ
 ละเอียดต่ำและความละเอียดสูง มาตัดแบ่งเป็นชิ้นย่อยๆ โดยจะพิจารณาในปริภูมิเทนเซอร์ด้วย
 การแยกค่าเอกฐานอันดับสูง ในกระบวนการเทรนนิ่ง จากนั้นกระบวนการสร้างคืนภาพสีหน้า
 คนจะแบ่งเป็นสองขั้นตอนได้แก่ การสร้างภาพคืนในส่วนของโครงสร้างหลักของใบหน้าและ
 ขั้นตอนถัดมาคือการสร้างคืนในส่วนของโครงสร้างที่เป็นชิ้นย่อยๆเฉพาะที่

เราสามารถยืนยันได้จาก ผลการทดลองบนฐานข้อมูลมาตรฐานด้วยภาพสีหน้าคน
 พบว่าวิธีการที่เรานำเสนอขึ้นมาสามารถสร้างคืนภาพได้อย่างมีประสิทธิภาพเพิ่มขึ้นจากวิธี
 ดั้งเดิม แต่การที่จะต้องนำภาพมาตัดออกเป็นชิ้นย่อยๆ ในกระบวนการเทรนนิ่งจะส่งผลให้เกิด
 กระบวนการคำนวณที่ซับซ้อนมากกว่ากระบวนการที่เรานำเสนอในวิธีแรก

ภาควิชา.....วิศวกรรมไฟฟ้า.....ลายมือชื่อนิสิต.....
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This dissertation proposes two novel frameworks for color face super-resolution reconstruction with higher-order singular value decomposition in four basic color systems such as RGB , YCbCr , HSV and CIELAB color system. The first framework is based on the linear regression model with MPCA since a color face image can be naturally described as tensors or multi-linear arrays. We find that the traditional method does not consider the correlation of data in each color channel. Therefore, there is an error in the face reconstruction process. In this dissertation, we investigate the performance of our proposed method in sense of effect of number of eigenvalue, effect of noise and complexity respectively and we can reconstruct the reasonable color face images which are compared with the ground truth color face images. In the second framework, we decompose each pair of low and high resolution training face images into a small patches and apply higher-order singular value decomposition in a tensor space. In color face reconstruction process, there are two steps : the first step tends to reconstruct a global face. Next step, the local detail is hallucinated from small overlapped patches. The experimental results from standard color facial database show that our second proposed framework can effectively reconstruct the color face images than the previous method. However, decomposing small patches in the training process will result in a more complicated process than that of the first framework.

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