



動的光線場照明の知能化による実体顔の「光貌」変容

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グランドチャレンジへの挑戦・研究開発課題での達成目標:

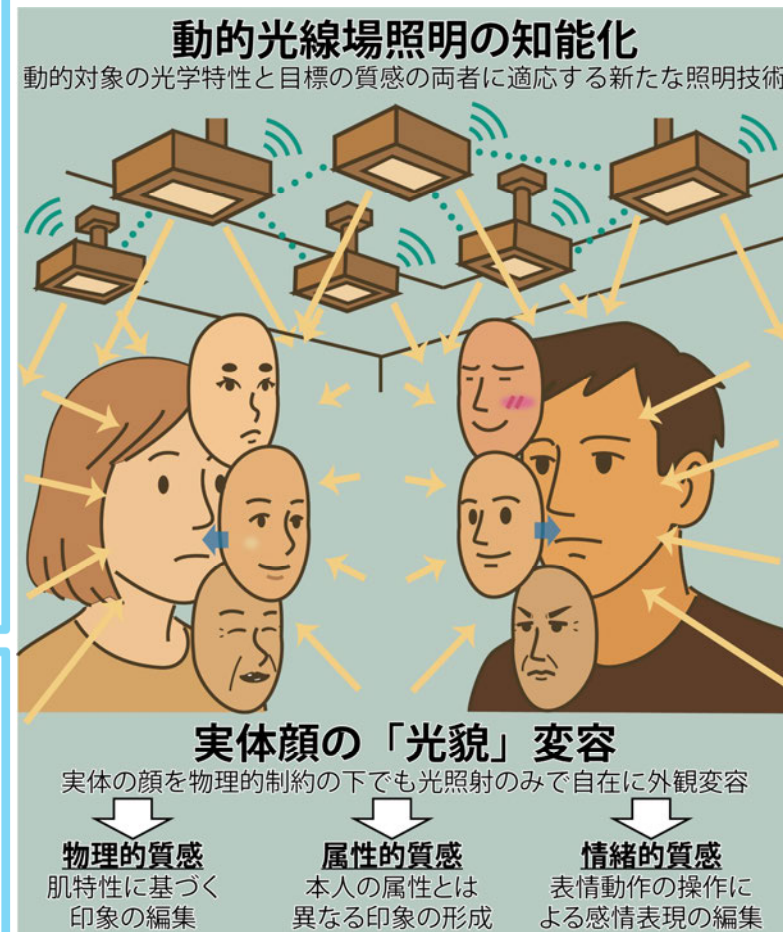
動的対象と光の相互作用、光による外観編集で生まれる質感までを理解した上で、能動的に光線場を制御する新たな照明技術と、実体の顔を物理的制約の下でも光照射のみで自在に外観編集する「光貌」変容を実現

研究概要:

- ・ **挑戦1**: 照明は視覚による実世界理解の基盤だが、その高い潜在能力をさらに発揮できないか?
- ・ **挑戦2**: 顔の選択肢を広げて、人の可能性をさらに広げられないか?
- ・ **戦略**: 外観を知的に制御可能な照明技術の開発と、光照射のみで顔の外観を柔軟に変える新たなリアリティ技術の実現
- ・ **研究課題**
 - ①: 動的光線場照明の基盤システムの開発
 - ②: 複雑反射の計測・制御に向けた高速ビジョン基盤
 - ③: 光貌変容の「自然さ」の視覚特性評価とモデル化
 - ④: 目標質感を再現する光照射・投影像生成技術

想定する社会的インパクト:

- ・ 現行の室内照明に代わる、人の能力を引き出す新たな社会基盤として進化
- ・ 顔の価値(肌・属性・情緒)を引き出し、幅広い応用・社会様式(美容、化粧、娯楽、医療、ケア、コミュニケーション等)を塗り替える





Intelligent Dynamic Light-field Illumination for Real-Face “Light-Morphing”

Principal Investigator: Yoshihiro Watanabe (Associate Professor, School of Engineering, Institute of Science Tokyo)

Co-PI: Sato Imari (National Institute of Informatics) • Shin'ya Nishida (Kyoto University) • Yoko Mizokami (Chiba University)

Grand Challenge and Goal:

We will realize an intelligent illumination that actively controls the light field by understanding the optical properties of dynamic objects and their interactions with light, and demonstrate its application as the novel concept of real-face “Light-Morphing”—flexibly transforming physical appearance through light projection, thereby creating a reality for adaptive appearance across contexts

Summary:

- **Challenge 1:** Illumination is the foundation of real-world understanding through vision, but can we unlock its higher potential?
- **Challenge 2:** By expanding the options of facial appearance, can we further broaden human possibilities?
- **Strategy:** Development of illumination technology capable of intelligently controlling appearance, and realization of a new reality technology that flexibly transforms facial appearance solely through light projection
- **Research objectives:** (1) fundamental system for dynamic light-field illumination, (2) high-speed vision for measuring and controlling complex reflections, (3) evaluation/modeling of Light-Morphing perception, and (4) optimization of illumination for reproducing target facial impressions

Social Impact:

- Evolving into a new social infrastructure that replaces conventional indoor lighting and enhances human potential
- Unlocking the value of the face—its skin, attributes, and emotions—and reshaping a wide range of applications and social practices, including beauty, cosmetics, entertainment, healthcare, caregiving, and communication

