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## Research Paper

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# Big Visual Data Analysis using Artificial Intelligence for Mass Valuation of Residential Properties in Australia

**By**

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## Key Highlights

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- Convolutional Neural Network (CNN) models were developed to use aerial and/or street view image data from publicly available sources such as Google or Microsoft Bing to construct visual desirability indicators that capture intangible attributes of residential houses. The fusion model incorporating a semi-log hedonic pricing (HP) model and the CNN models were estimated onto three single-year datasets covering houses located across 128 suburbs in Brisbane in three executive years from 2018 to 2020.
- The inclusion of the visual desirability indicator constructed by the CNN model using street-view images would reduce the root mean square of errors (RMSE) errors of prediction by 11 – 21 per cent, varying from year to year.
- The inclusion of the visual desirability indicator constructed by the CNN model using aerial images would reduce the root mean square of errors (RMSE) errors of prediction by 20 – 29 per cent, varying from year to year. These empirical results imply that using visual data, either aerial or street-view images, significantly enhances the predictive accuracy of HP models which are the backbone of automatic valuation models currently deployed in the Australian real estate markets.
- These results are robust in comparison to the HP baseline model which considers house attributes (e.g. bed rooms, bathroom, car spaces and land area), distances from facilities (e.g. shops, education centers, medical/hospital, and public transport stations), distance from noise sources such highways, and other attributes of the community such as crime rates, population density, and school quality.
- The CNN and fusion models developed can be deployed in an Artificial Intelligence (AI)-enabled automatic manner to provide better AVMs while further improvement is also possible.



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## Author Profiles

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### **Associate Professor Viet Ngu Hoang**

#### **School of Economics & Finance, QUT**

Associate Professor Viet-Ngu Hoang is a Senior Applied Economist at Queensland University of Technology (QUT). His research focuses on organizational performance and the behaviors of families and individuals across different contexts and sectors. He holds a PhD from the University of Queensland and is recognized for his contributions in these fields. His work includes over 80 publications and leadership in the Social Systems Domain at QUT.

### **Dr Kien Thanh Nguyen**

#### **Senior Research Fellow, School of Electrical Engineering & Robotics, QUT**

Dr. Kien Thanh Nguyen is an expert in computer vision and machine learning, specializing in applications such as biometrics (face and iris identification) and surveillance. He has over 10 years of experience in these fields, focusing on the development and application of advanced computer vision technologies. Currently affiliated with Queensland University of Technology (QUT), Dr. Nguyen's research interests include deep learning and its applications in various domains.



### **Dr Andrea Blake**

#### **Senior Lecturer, Faculty of Business and Law, QUT**

Andrea Blake has over 15 years experience as an academic with the Queensland University of Technology and is currently a senior lecturer in property economics. During this period Andrea has published papers and spoken at international academic conferences on topics including property rights, valuation liability and practice, and property education. Andrea's PhD is in carbon sequestration and the impact on rural land and valuation practice.