Método inteligente para identificar potencial de renovación urbana basado en la teoría del gen espacial: Shanghái

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Resumen: En la etapa de planificación sobre el stock urbano, identificar con precisión el potencial de renovación es central. El estudio usa datos de cubiertas de edificios de Shanghái, extrae indicadores morfológicos, identifica siete genes espaciales mediante mezcla gaussiana y predice el potencial con bosque aleatorio.

Palabras clave: gen espacial; renovación urbana; morfología edificada; mezcla gaussiana; bosque aleatorio; Shanghái

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1 Contexto de investigación

La renovación urbana china pasa de la expansión a la optimización fina del stock. La teoría del gen espacial permite leer la morfología edificada como expresión medible de trayectorias históricas y sociales.

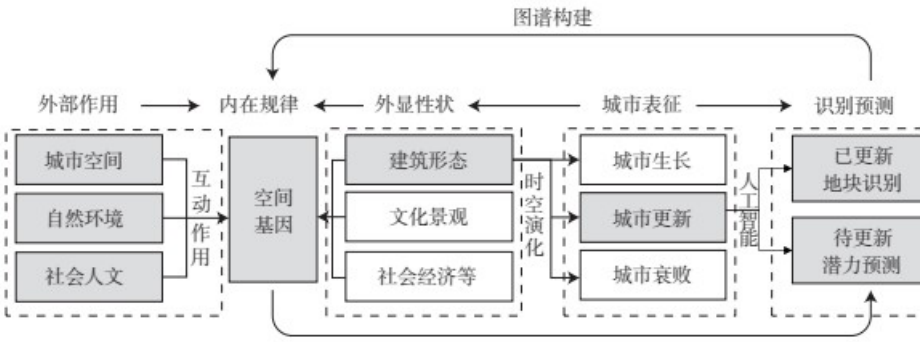

Fig. 1 Research framework

2 Revisión

Los estudios morfológicos descomponen parcelas, calles y edificios, pero suelen ser estáticos. El trabajo introduce datos multianuales y aprendizaje automático para captar la evolución.

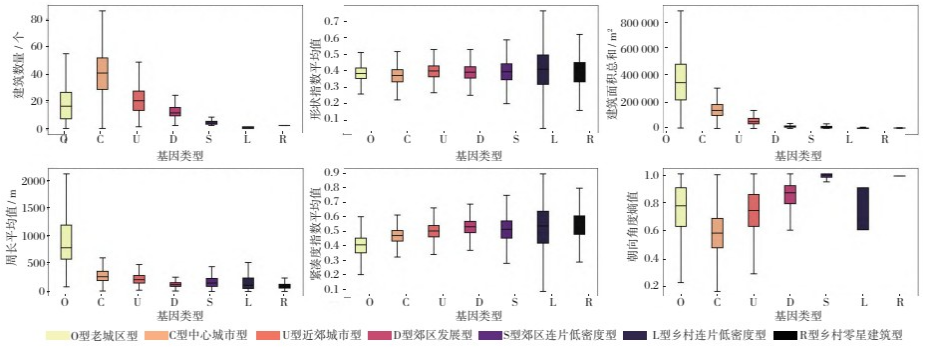

Fig. 2 Morphological characteristics of seven spatial-gene types in Shanghai, 2016

3 Morfología edificada de Shanghái

El análisis cubre Shanghái con datos de cubiertas 2016-2021 y seis indicadores: superficie construida, perímetro medio, entropía de orientación, índice de forma, compacidad y número de edificios.

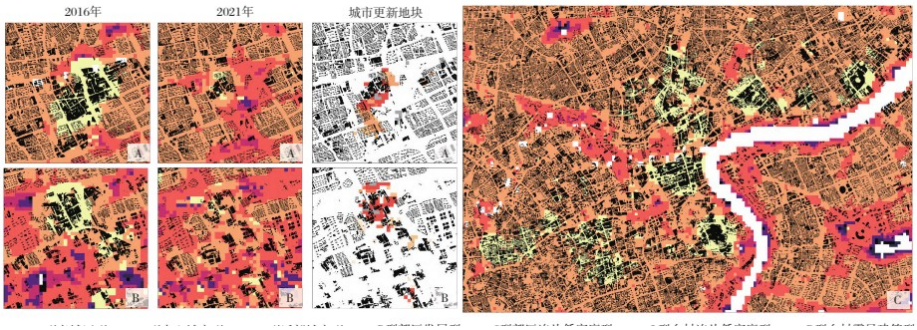

Fig. 3 Identified urban-renewal areas in Shanghai, 2016-2021

4 Identificación de genes espaciales

La mezcla gaussiana distingue siete tipos, desde urbano antiguo hasta rural disperso. Las parcelas que pasan del tipo antiguo al central se consideran renovadas.

参数名称	设定值	取值范围
N_estimators	300	[100, 500]
Max_depth	None	[None, 20]
Max_features	'sqrt'	['sqrt', 'log2']
Min_samples_split	2	[2, 10]
Min_samples_leaf	1	[1, 5]

Tabla 1 Random forest parameters

5 Predicción del potencial

El bosque aleatorio alcanza buena precisión. Influyen superficie, distancia a centros distritales, perímetro, edad de construcción, centralidad y precio de vivienda.

图4 特征重要性分布（左）和SHAP蜂巢图（右）

Fig. 4 Feature importance and SHAP beeswarm plot

6 Conclusiones

El alto potencial se concentra entre anillos y en antiguos centros suburbanos. El método ofrece una herramienta para una gobernanza metropolitana más precisa y dinámica.

Fig. 5 Predicted renewal potential in representative districts

Tab.2 List of high-potential areas for urban renewal

区域	更新高潜力地区
浦东新区	三林镇、北蔡镇、祝桥镇
长宁区	虹桥街道、程家桥街道、华阳路街道、江苏路街道
黄浦区	小东门街道、老西门街道、南京东路街道、瑞金二路街道
普陀区	真如镇街道、桃浦镇、长风新村街道、长寿路街道
静安区	天目西路街道、大宁路街道、共和新路街道、彭浦新村街道、静安寺街道、南京西路街道
虹口区	嘉兴路街道、广中路街道
杨浦区	江浦路街道、四平路街道、五角场街道
徐汇区	田林街道、漕河泾街道、龙华街道、徐家汇街道、天平路街道、湖南路街道
闵行区	华漕镇、七宝镇、马桥镇、梅陇镇、吴泾镇、莘庄镇、浦江镇
宝山区	大场镇、杨行镇、顾村镇、高境镇
松江区	中山街道、永丰街道、泗泾镇、新桥镇、车墩镇、九亭镇、洞泾镇
青浦区	香花桥街道、夏阳街道、华新镇、赵巷镇、徐泾镇
奉贤区	南桥镇
嘉定区	新成路街道、江桥镇、安亭镇、马陆镇
金山区	朱泾镇、金山卫镇
崇明区	城桥镇

Tabla 2 List of high-potential urban-renewal areas

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