Analysis of Land Surface Temperature (LST) across Varying Urban Land Covers in Minneapolis, Minnesota

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GEOG 5541: Principles of Geocomputing
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Introduction

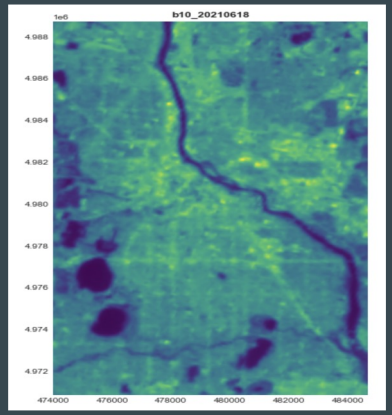
Motivations

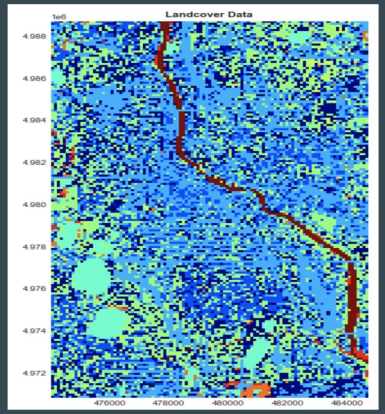
- Climate Change → Anthropogenic Change
  - Urbanization/Urban Sprawl, Urban Heat Island Effect, etc...
- Green Spaces can combat against UHI, amongst many other anthropogenic issues

Goals

- Understand the relationship between LST & land cover in an urban environment
- Create tools that can aid in developing a workflow for continued analysis

Solution

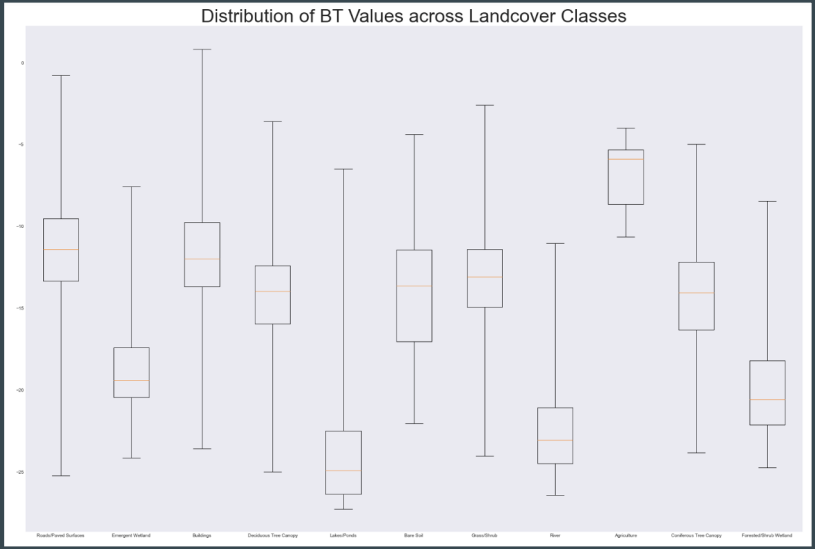





```python
def generateBT(DN, Ml, Al, K1, K2):
    """Given a DN value and other necessary values from metadata, will convert to Brightness Temperature (BT)."""

    # Calculating TOA Reflectance
    TOA = (Ml * DN) + Al

    # Calculating BT (in °C)
    BT = (K2 / (np.log((K1 / TOA) + 1))) - 273.15

    # Converting BT from °C to °F
    F = (BT * (9/5)) + 32

    return F
```

```python
# Function to Run ANOVA from Summary Statistics
def anovaFromSummaryStats(df):
    """ Pass in DF with the follwing field names ['mean', 'std', 'n', 'label'] """

    # Checking DF Columns & Names
    try:
        "mean" in df.columns
        "std" in df.columns
        "n" in df.columns
        "label" in df.columns
        len(df.columns) == 4
    except:
        raise Exception("Dataframe must only contain the following columns ['mean', 'std', 'n', 'label'].")

    # Calculating Grand Mean
    grand_mean = df["mean"].mean()

    # Calculating New Values
    df["squared"] = (df["n"] * ((df["mean"] - grand_mean)**2))
    df["variance"] = (df["std"]**2)

    # Calculating Other Global Values
    dfB = (len(df["n"])-1)
    dfE = ((df["n"].sum()) - dfB)
    MSb = ((df["squared"].sum()) / (len(df["squared"])-1))
    MSe = ((df["variance"].sum()) / (len(df["variance"])))
    F = (MSb / MSe)
    p = (1 - f.cdf(F, dfB, dfE))

    # Displaying Results
    print("dfB=" + str(dfB) + "\n" +
          "dfE=" + str(dfE) + "\n" +
          "MSb=" + str(MSb) + "\n" +
          "MSe=" + str(MSe) + "\n" +
          "F=" + str(F) + "\n" +
          "p-value=" + str(p))
```

Results



	Roads/Paved Surfaces	Emergent Wetland	Buildings	Deciduous Tree Canopy	Lakes/Ponds	Bare Soil	Grass/Shrub	River	Agriculture	Coniferous Tree Canopy	Forested/Shrub Wetland
min	-25.21514	-24.136001	-23.583965	-24.996943	-27.270527	-22.029046	-24.039819	-26.434431	-10.629167	-23.831678	-24.746895
max	-0.77504	-7.580332	0.836044	-3.572527	-6.490318	-4.377261	-2.581607	-11.026937	-3.991509	-4.992547	-8.45155
p25	-13.328226	-20.461974	-13.675045	-15.963244	-26.377261	-17.029677	-14.944642	-24.48931	-8.639985	-16.335971	-22.131583
p75	-9.528802	-17.399786	-9.765376	-12.402922	-22.502995	-11.445872	-11.418629	-21.070822	-5.311635	-12.172602	-18.20822
mean	-11.53749	-18.400156	-11.632352	-14.365766	-23.927961	-14.199766	-13.310615	-22.552634	-6.665833	-14.245937	-19.93068
std	-167.000542	-164.642602	-166.35906	-166.429887	-166.092267	-162.144362	-166.272937	-170.467122	-173.342281	-164.590163	-167.600648
median	-11.411365	-19.384162	-11.979149	-13.963524	-24.904124	-13.612255	-13.077903	-23.066158	-5.88228	-14.052415	-20.578833
count	64371	1285	32855	52691	8198	326	42369	4685	24	3027	1393

```
dfB=10
dfE=211214
MSb=265477.2543497169
MSe=27834.656515213428
F=9.537651531809509
p-value=4.440892098500626e-16
```