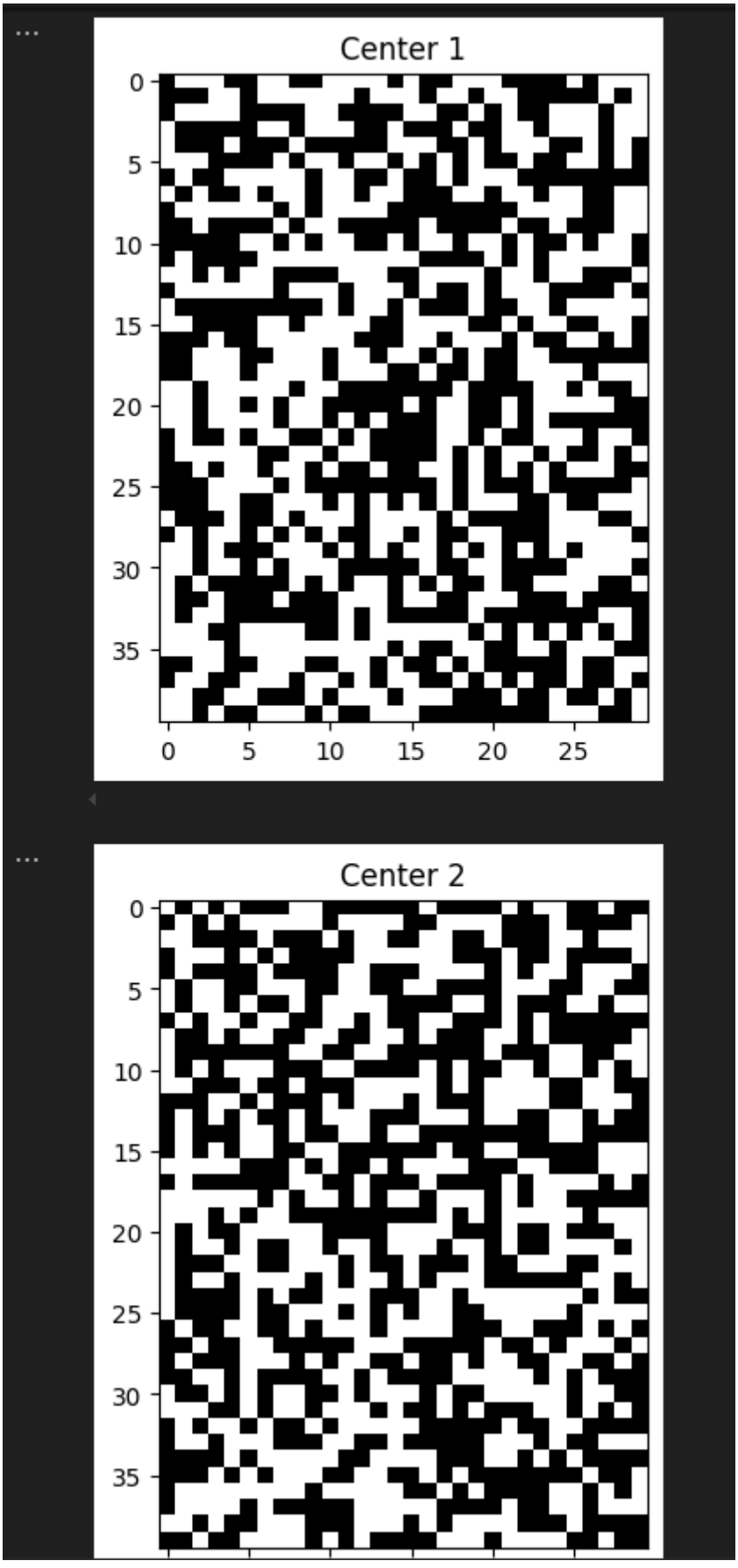
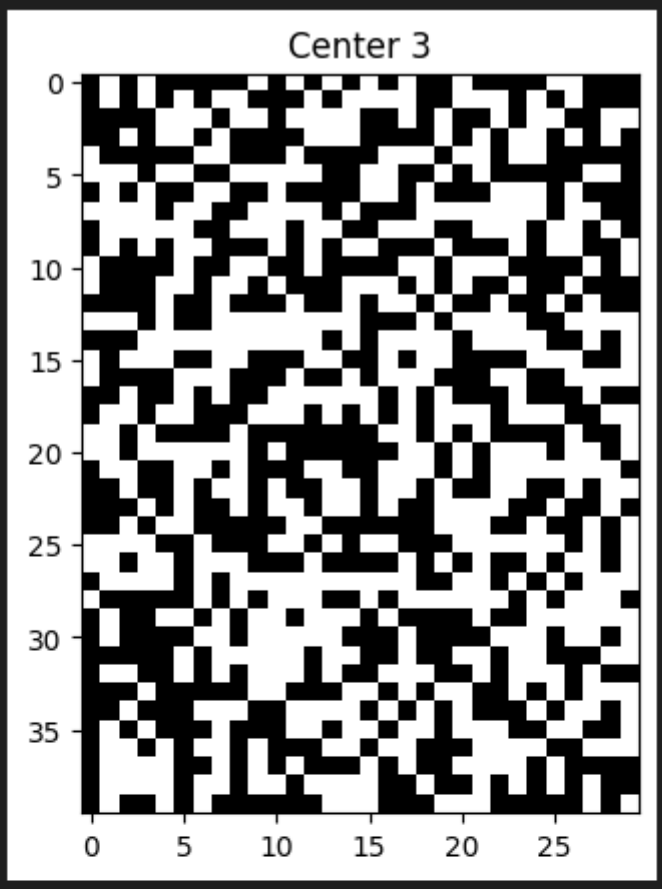
a.I:

شاخص های تصادفی اولیه

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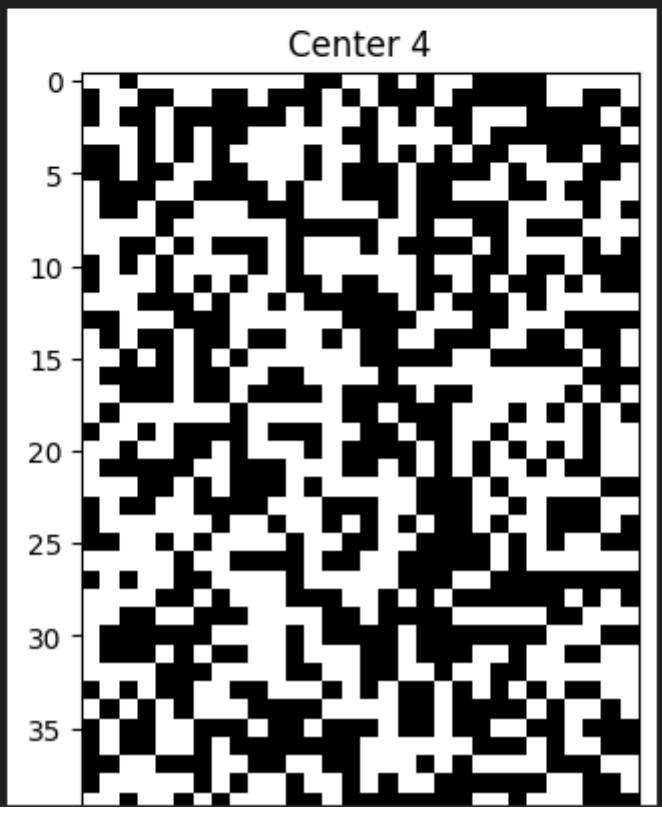
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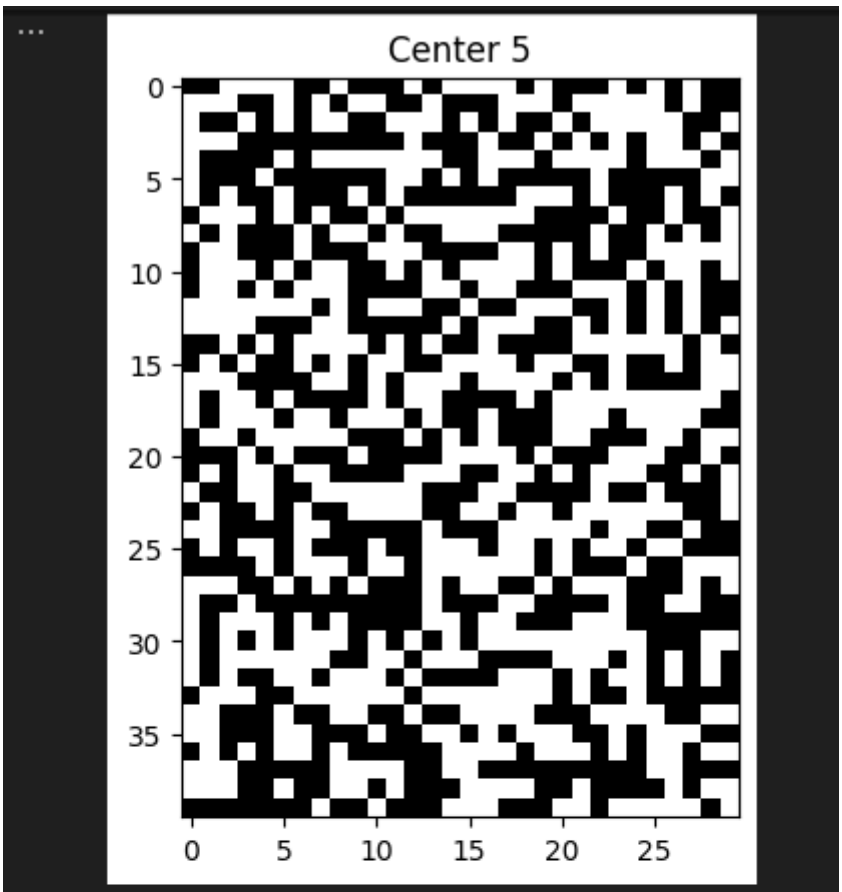
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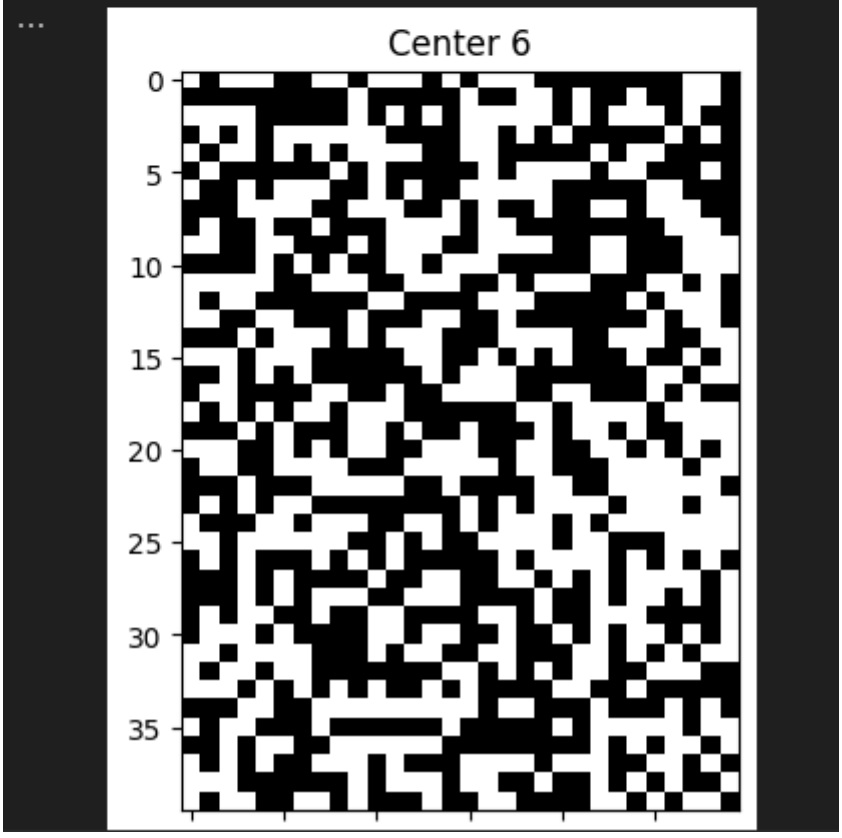
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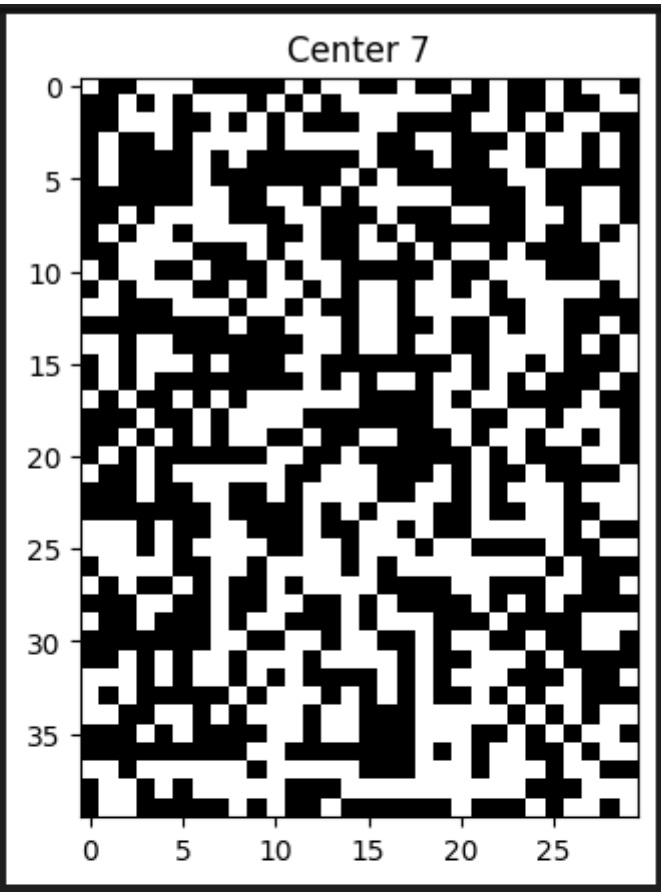
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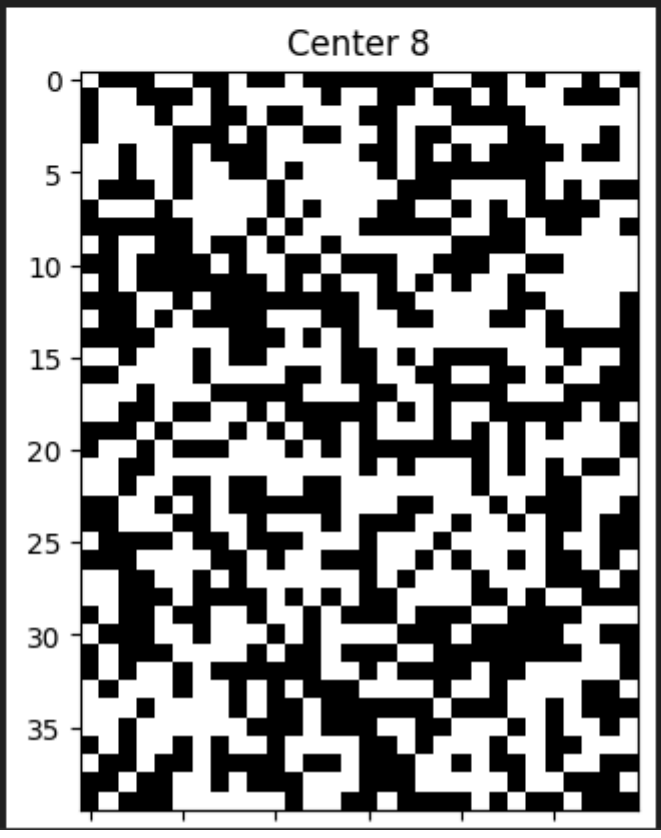
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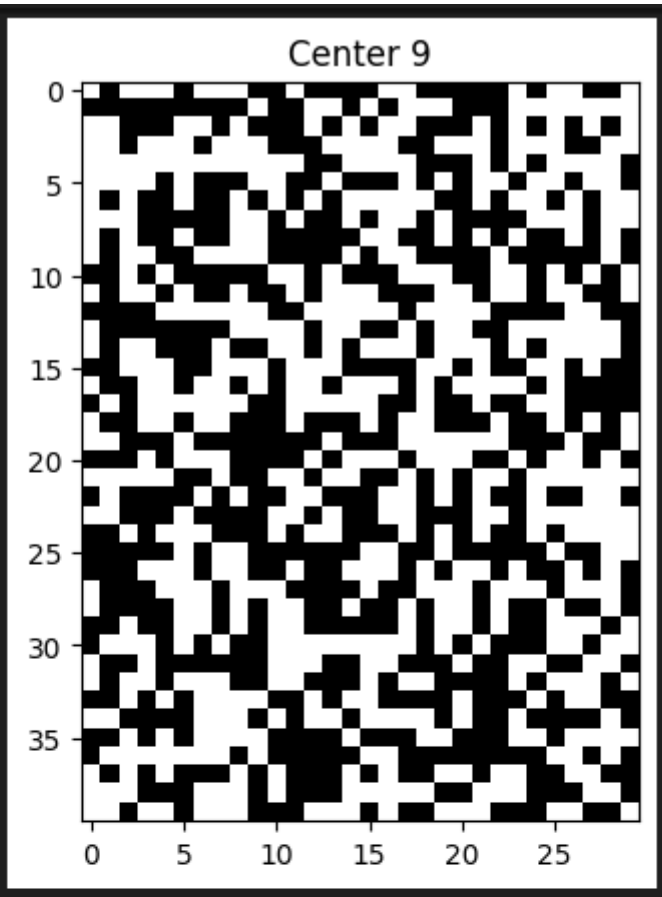
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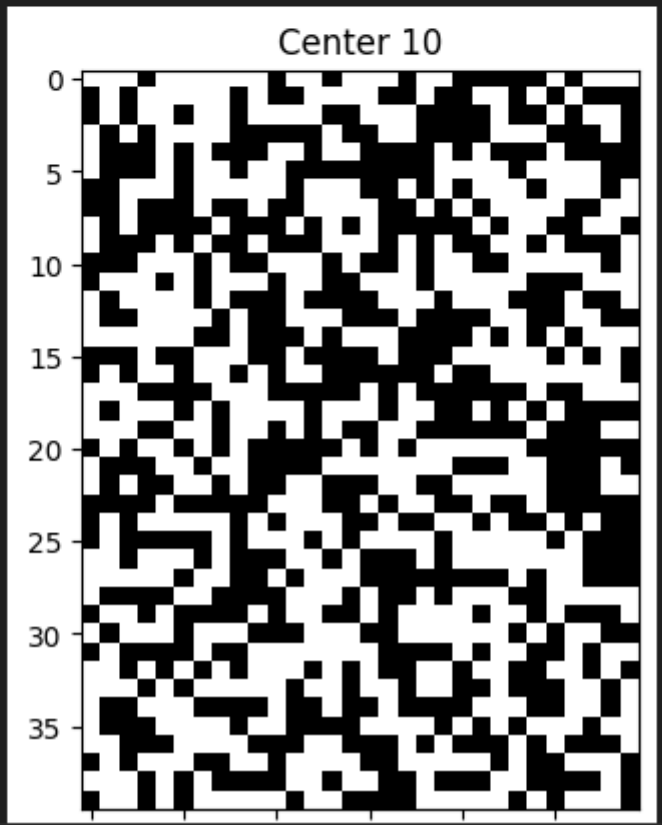
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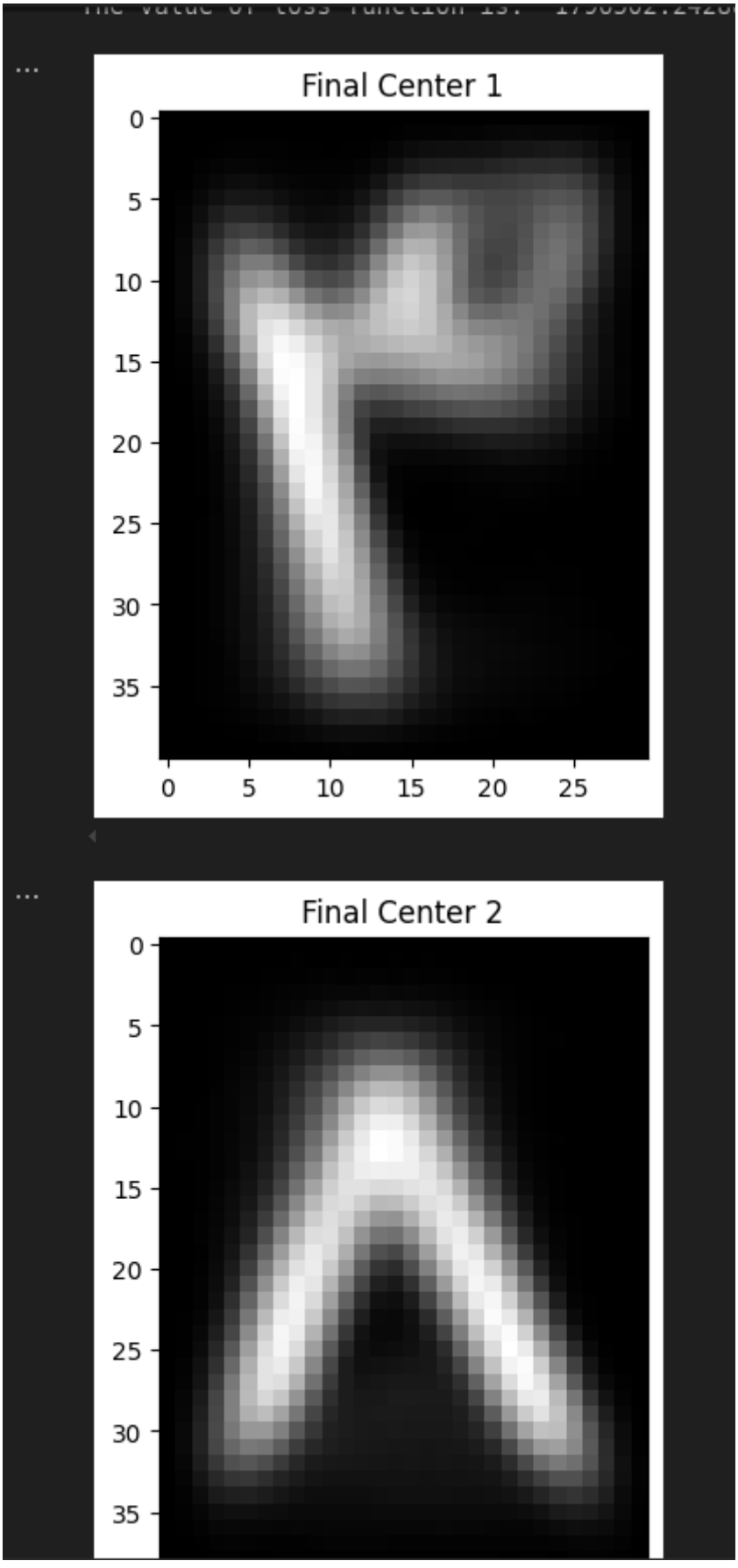
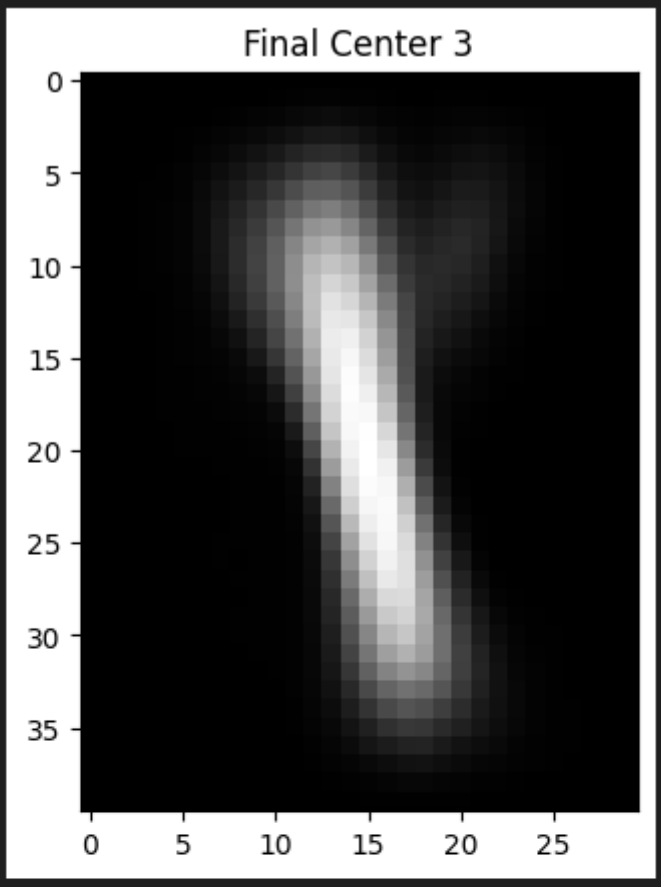
شاخص ها نهایی

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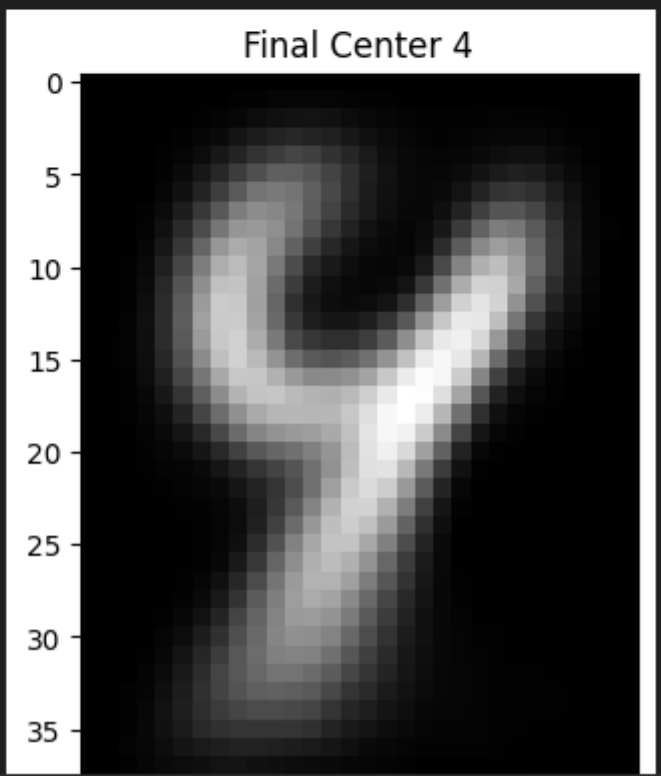
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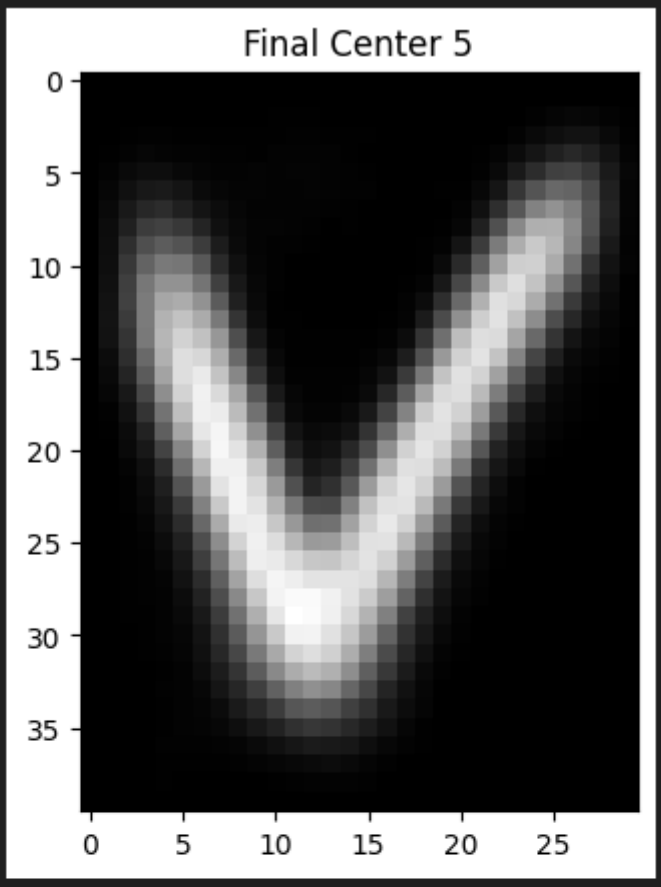
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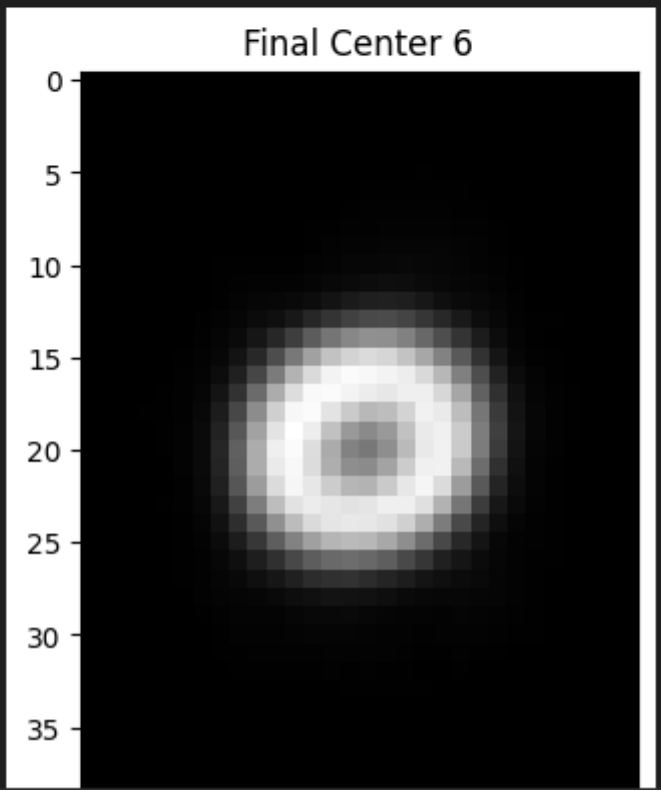
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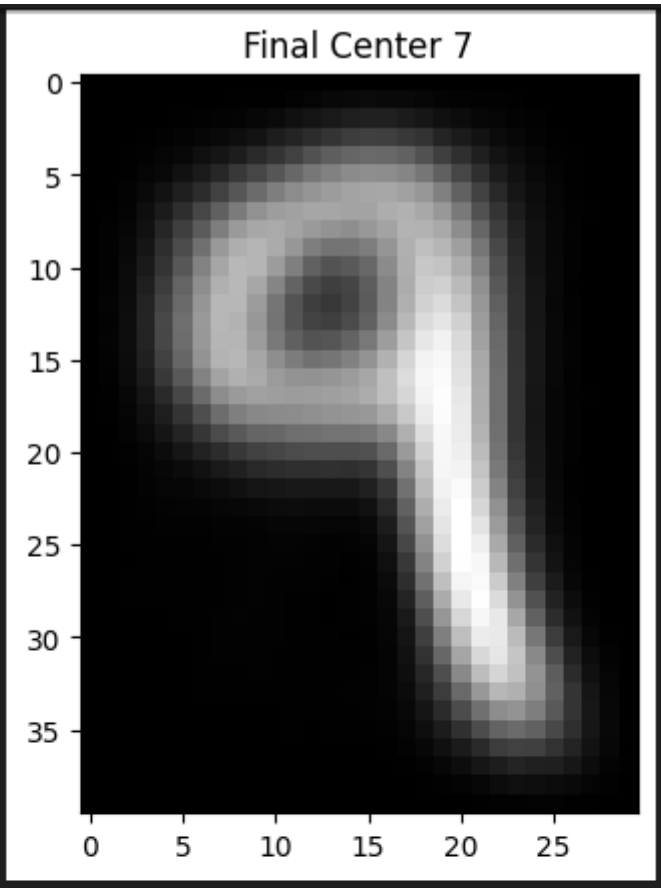
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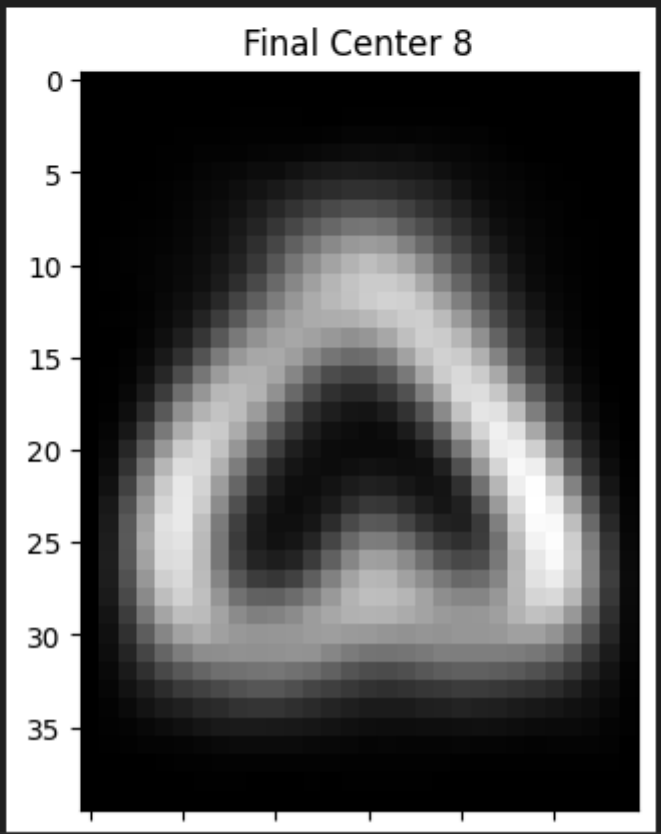
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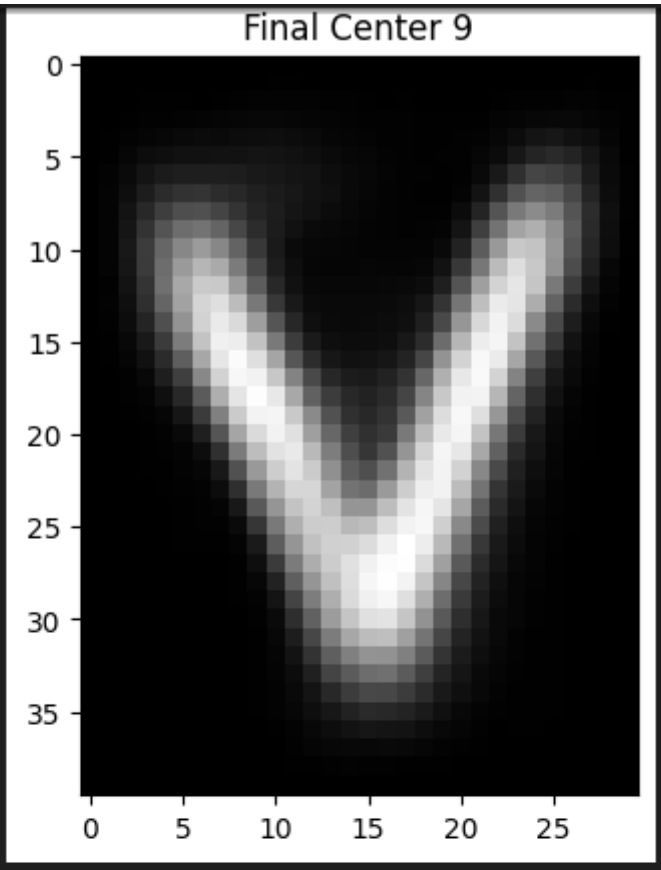
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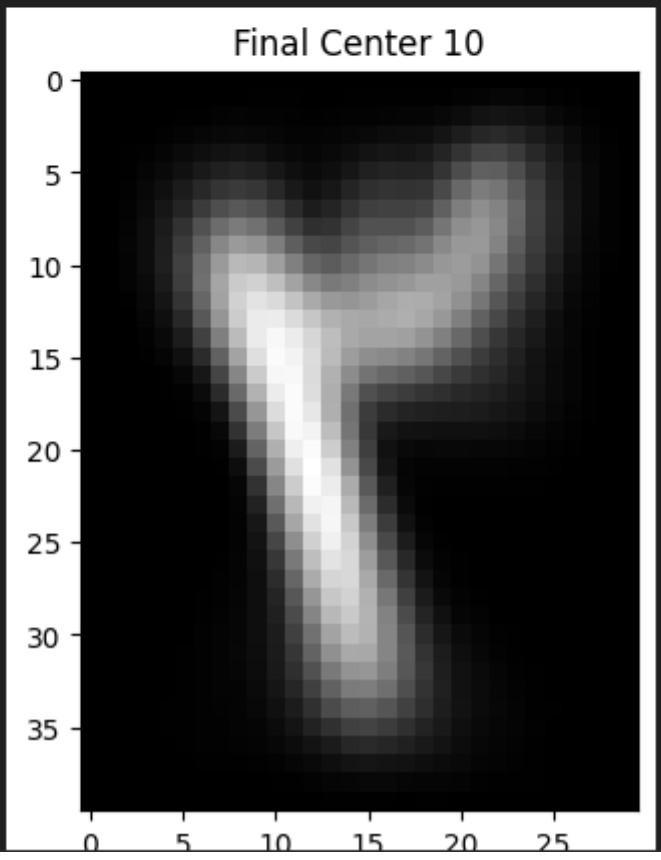
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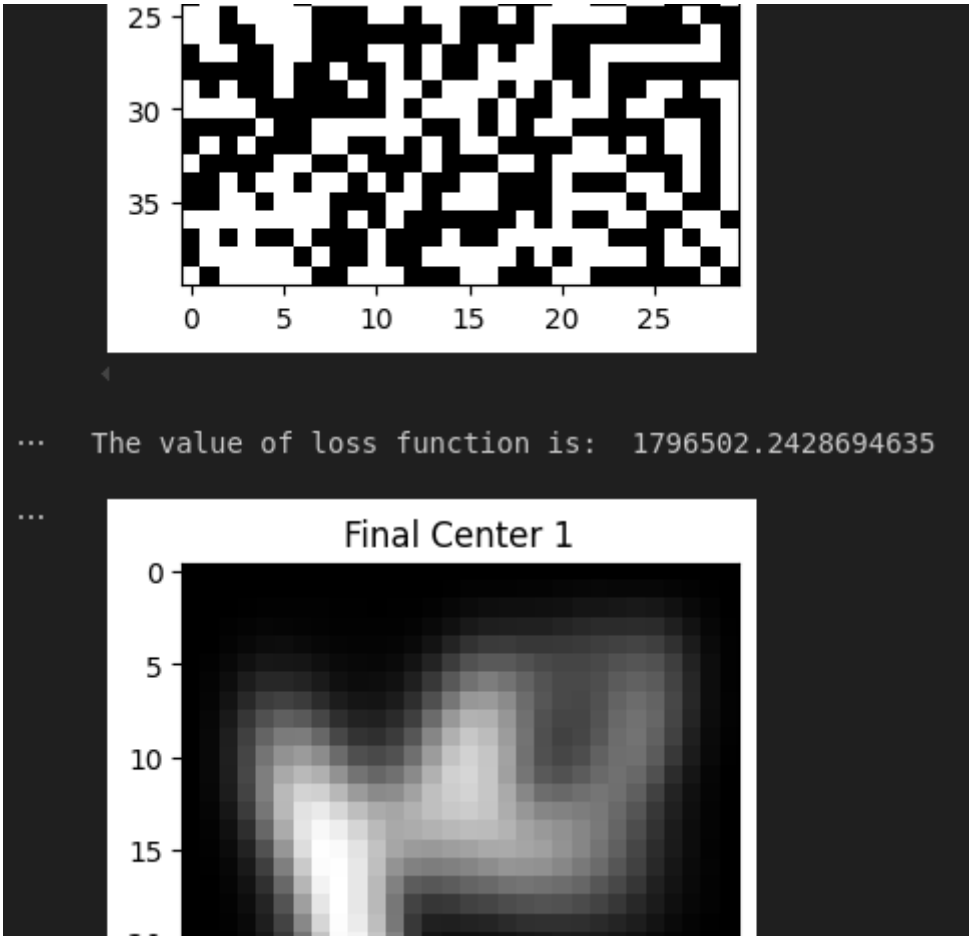
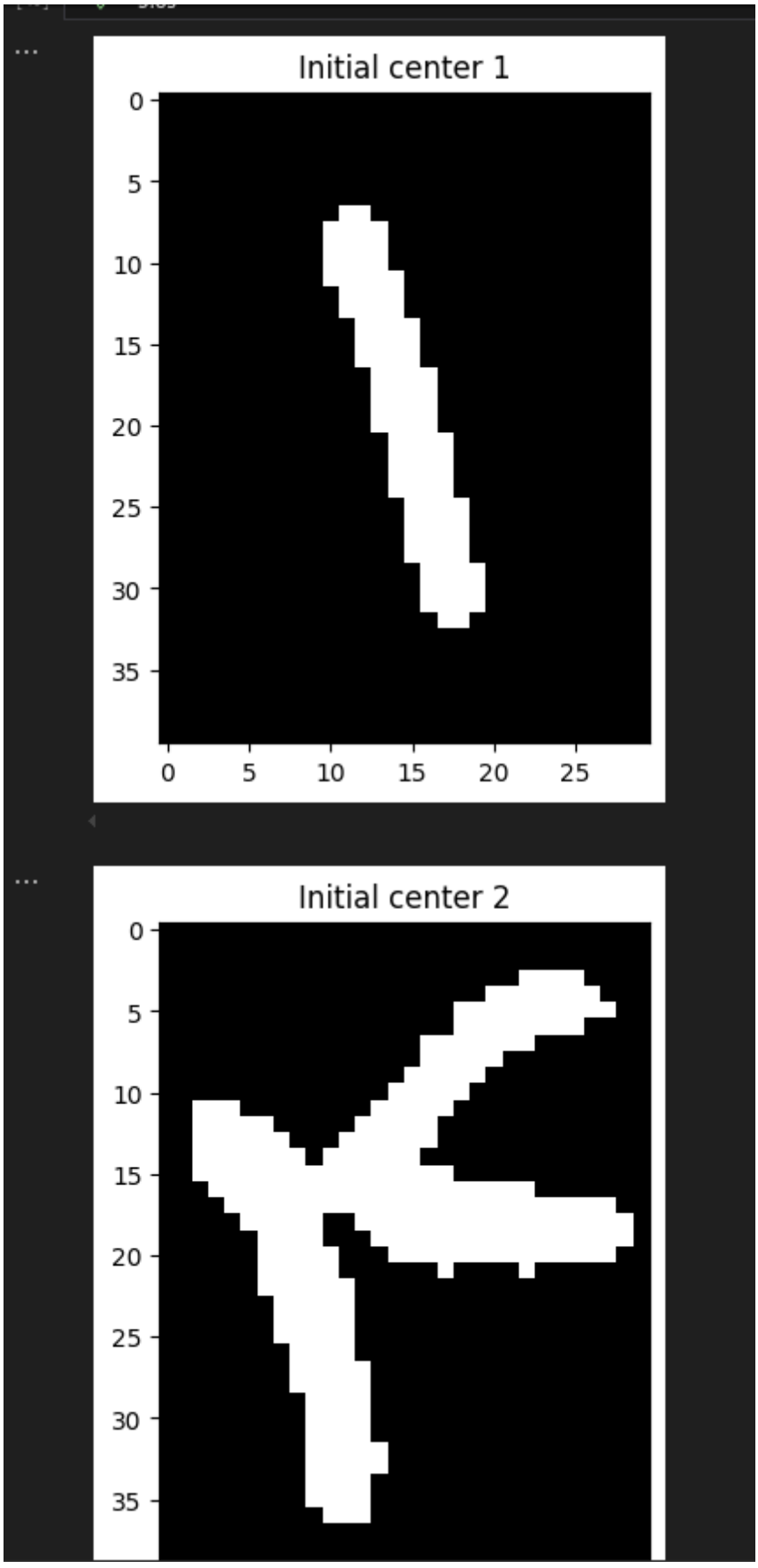
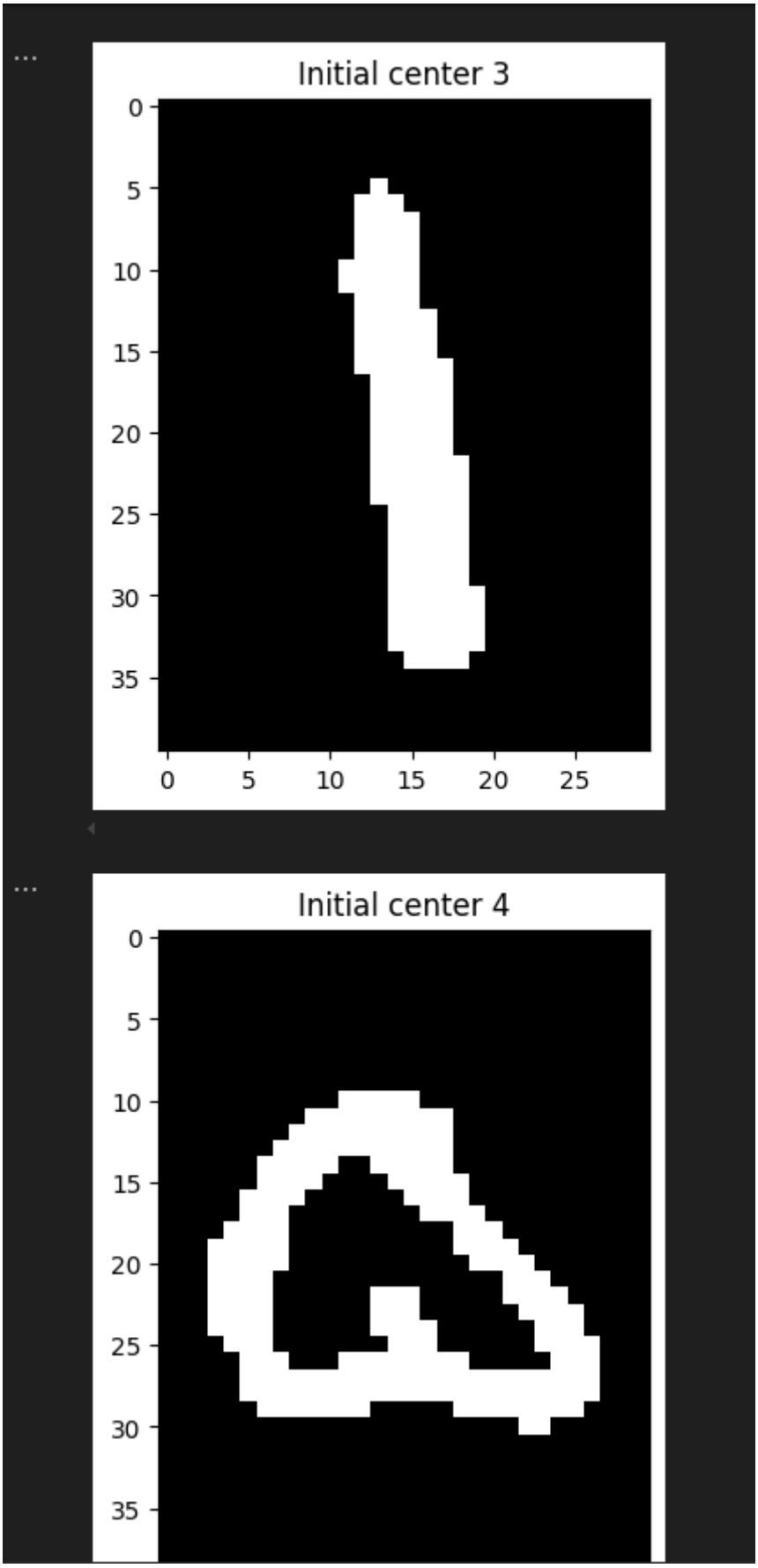
مقدار تابع هزینه



a.II:

شاخص های تصادفی انتخاب شده از بین داده ها

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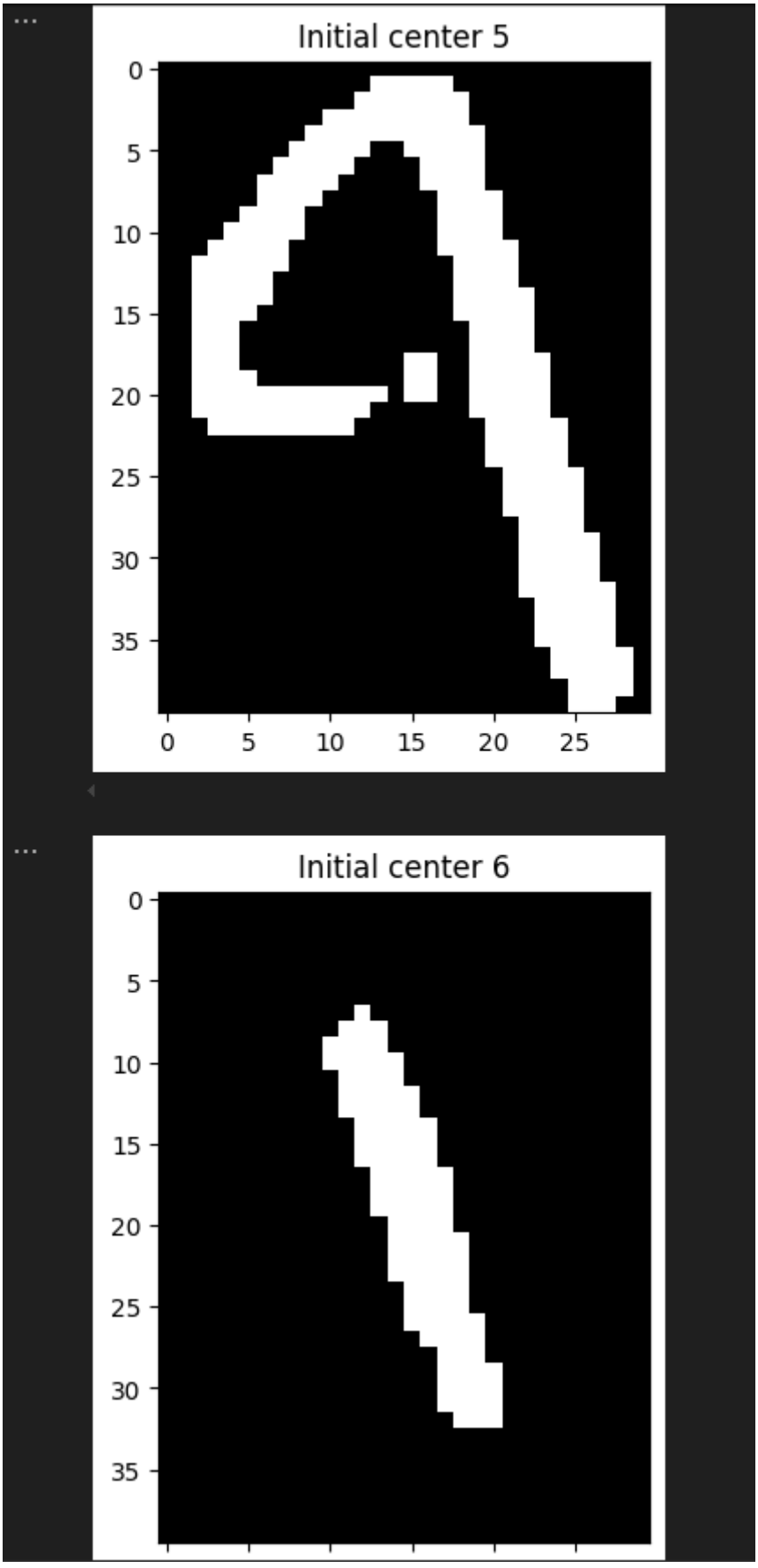
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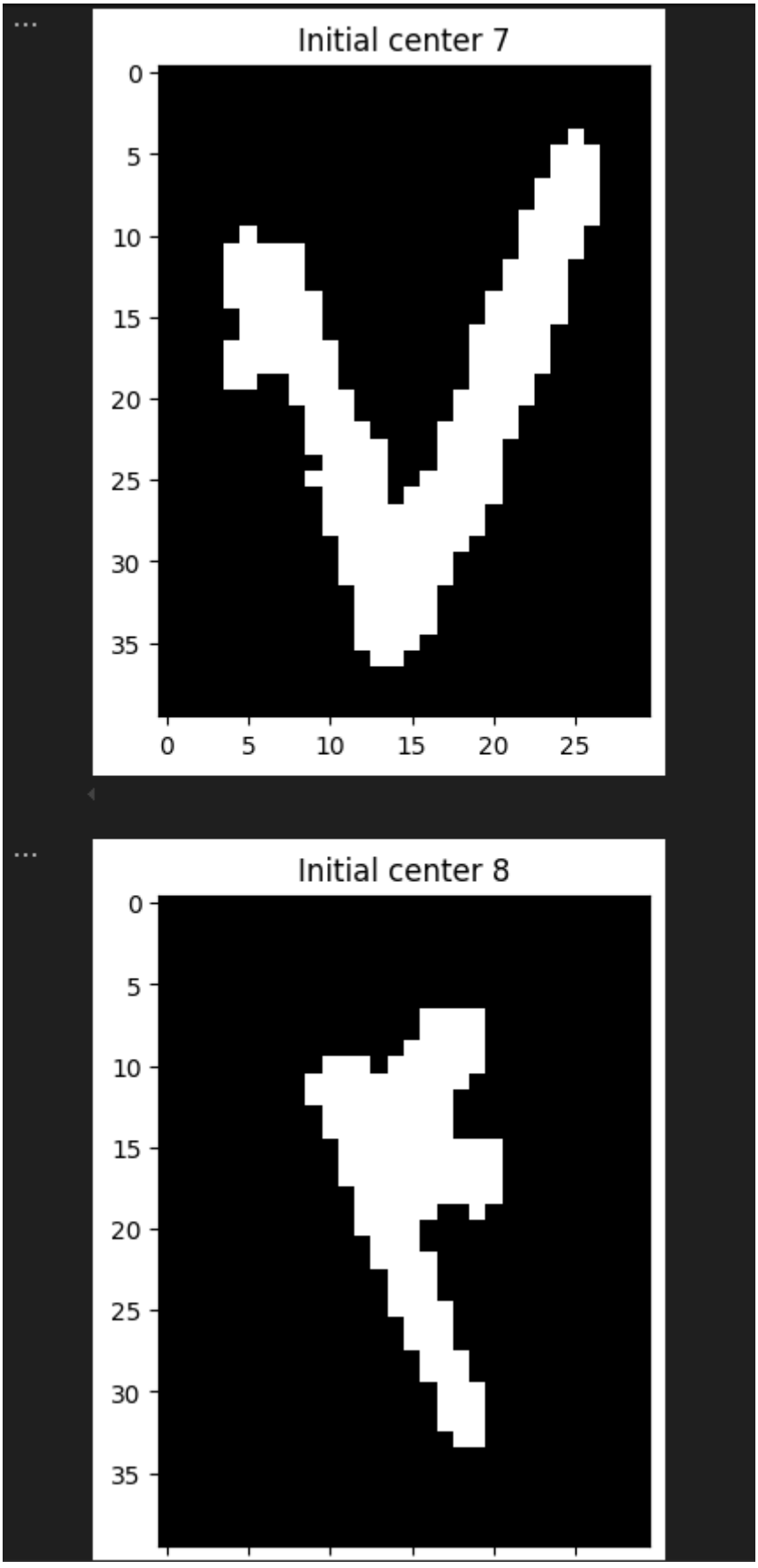
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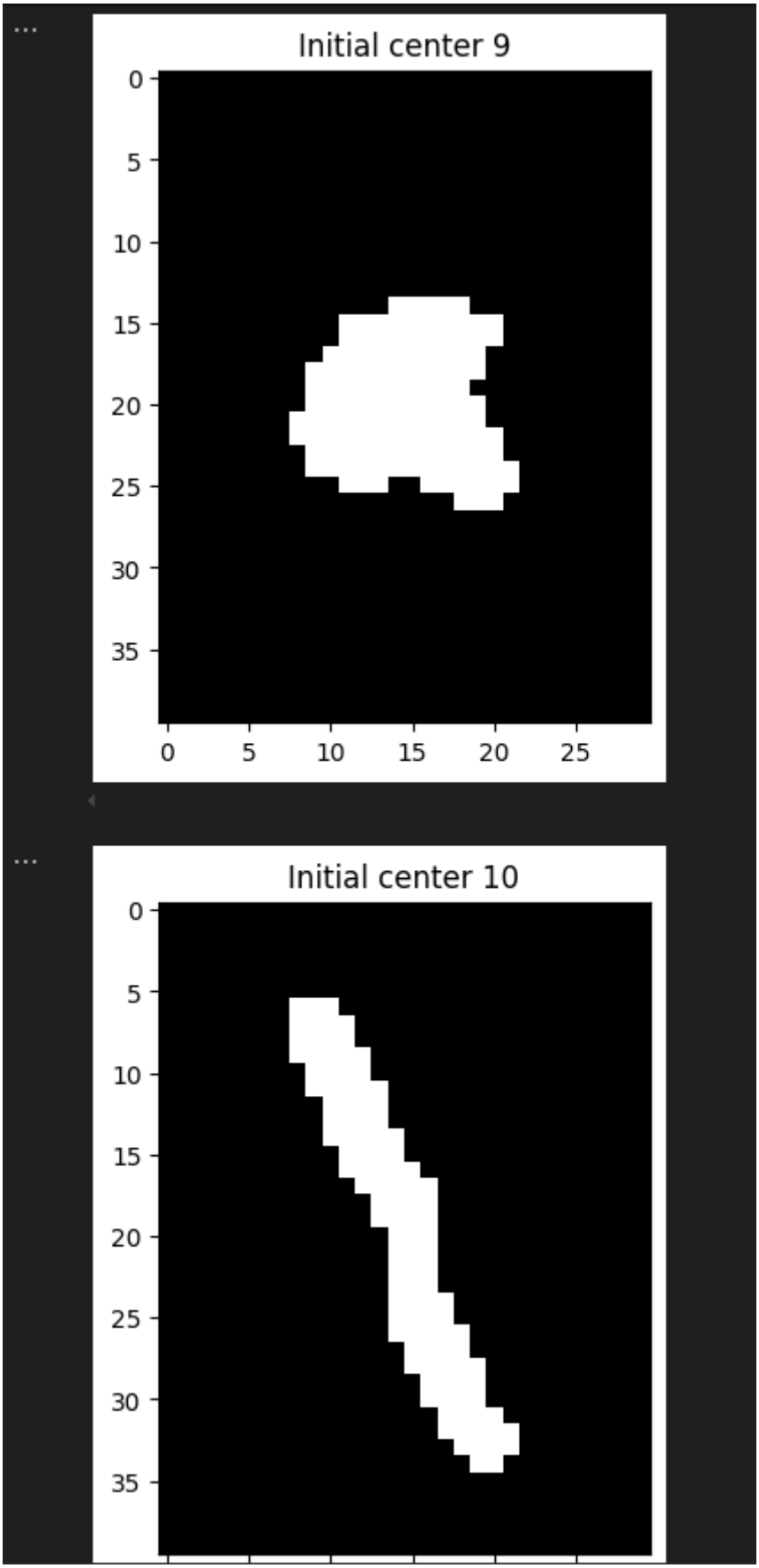
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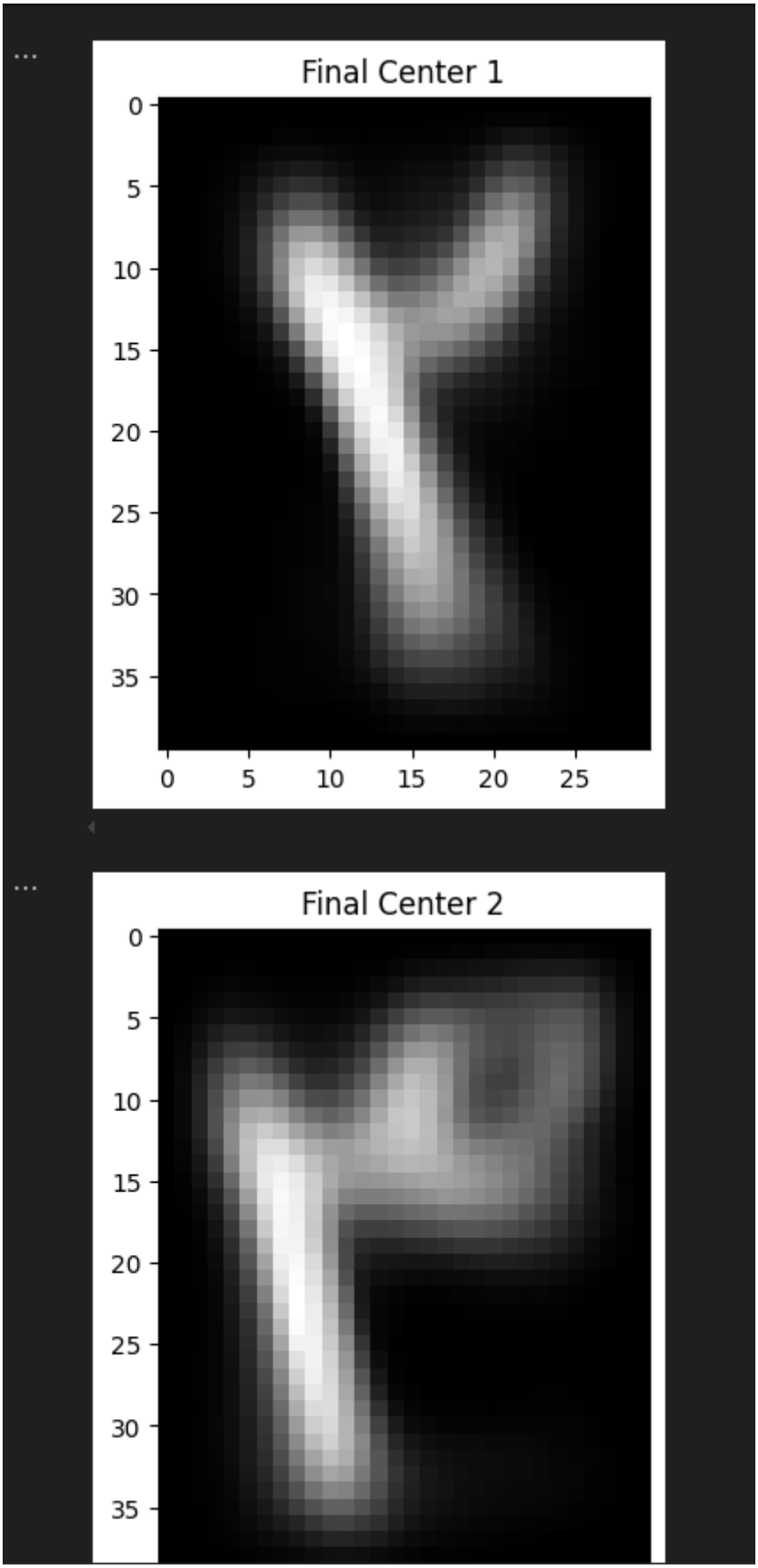
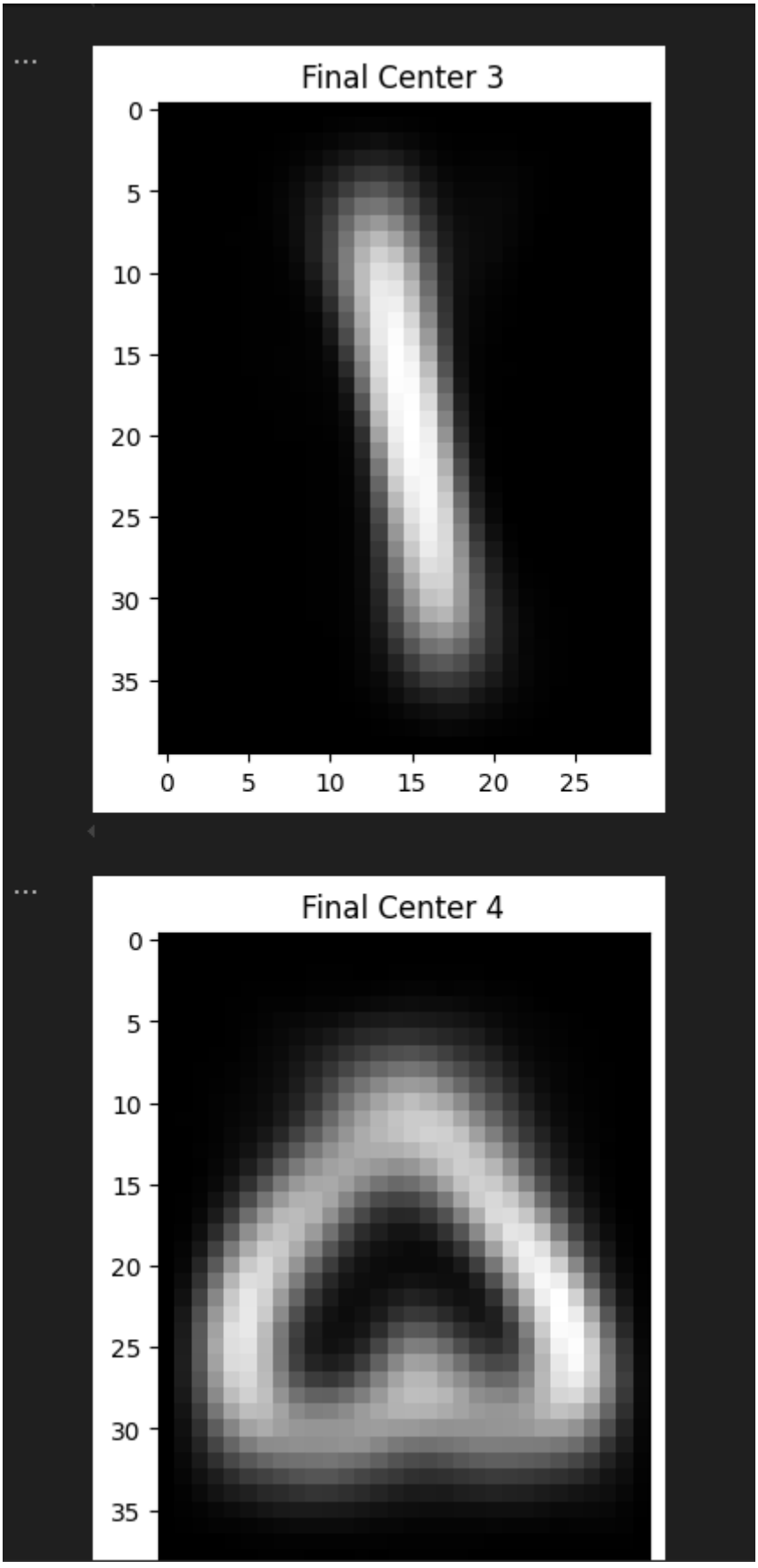
شاخص های نهایی

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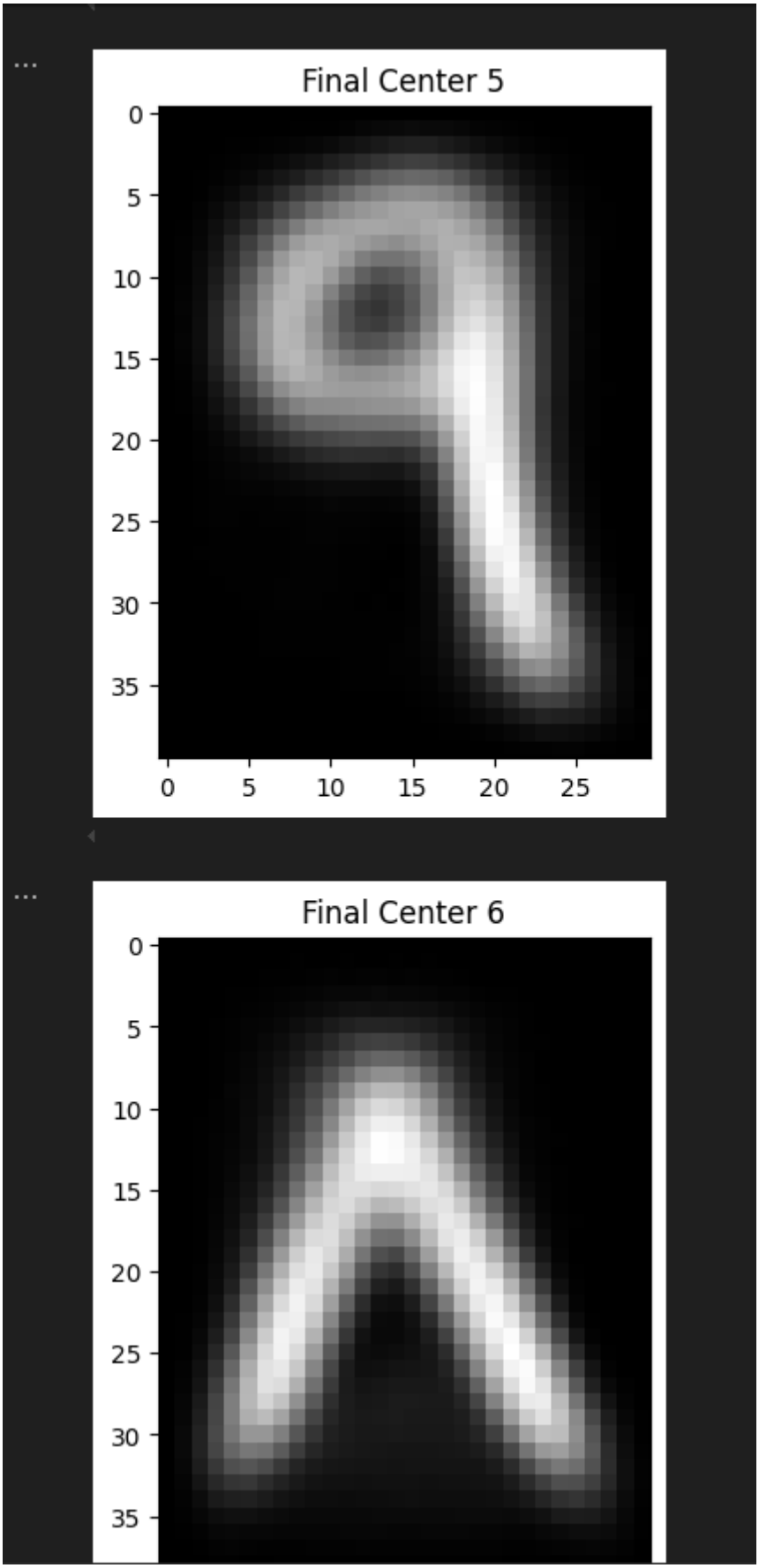
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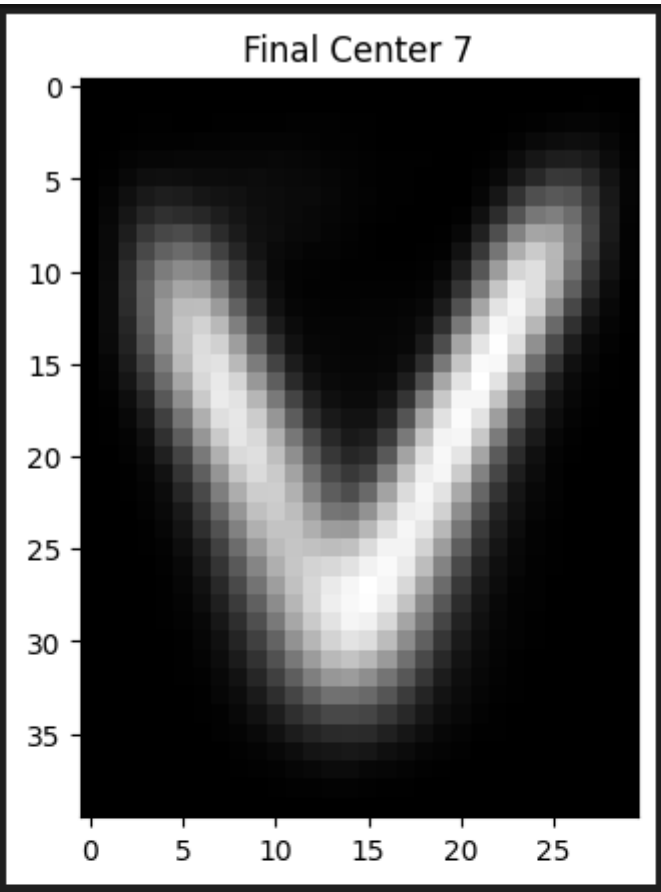
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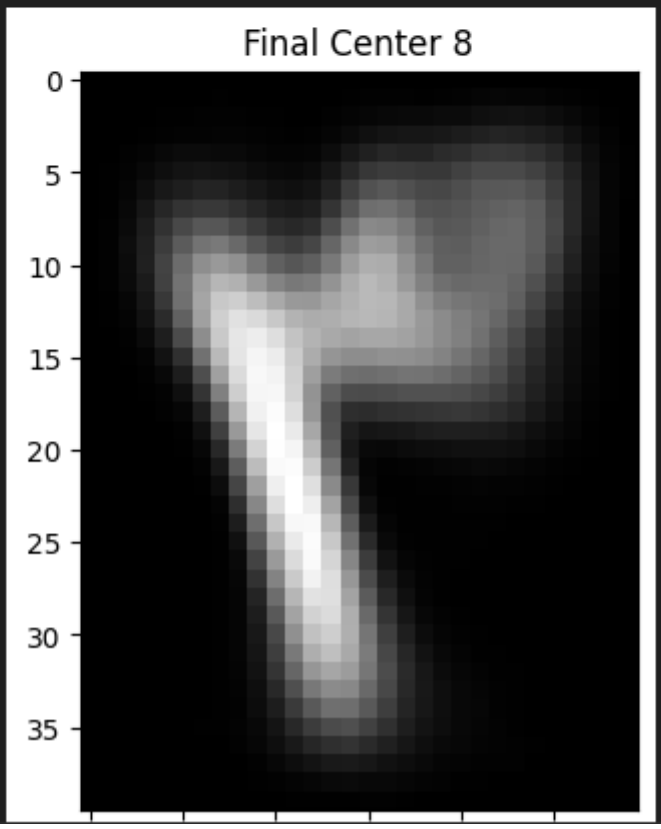
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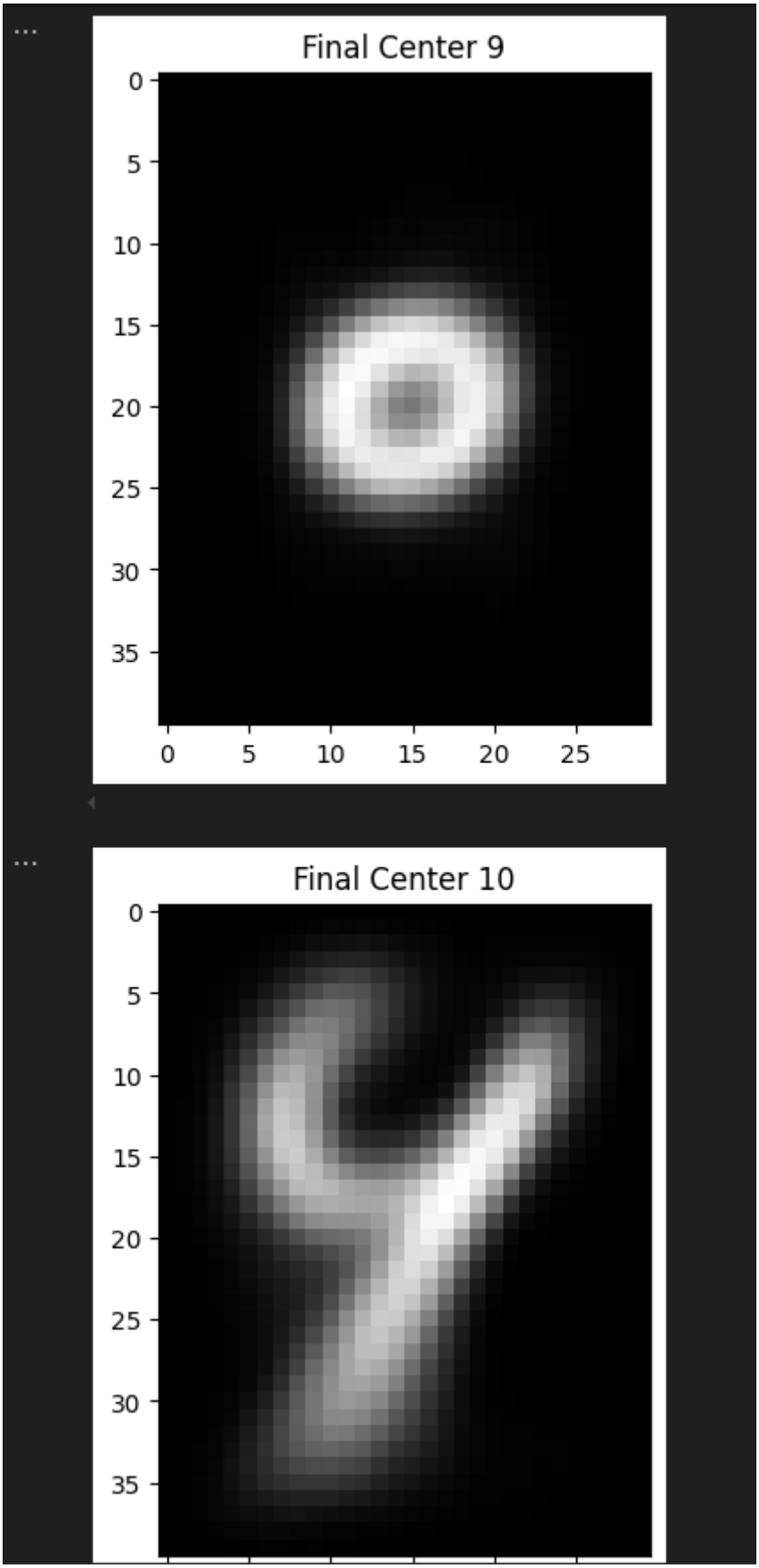
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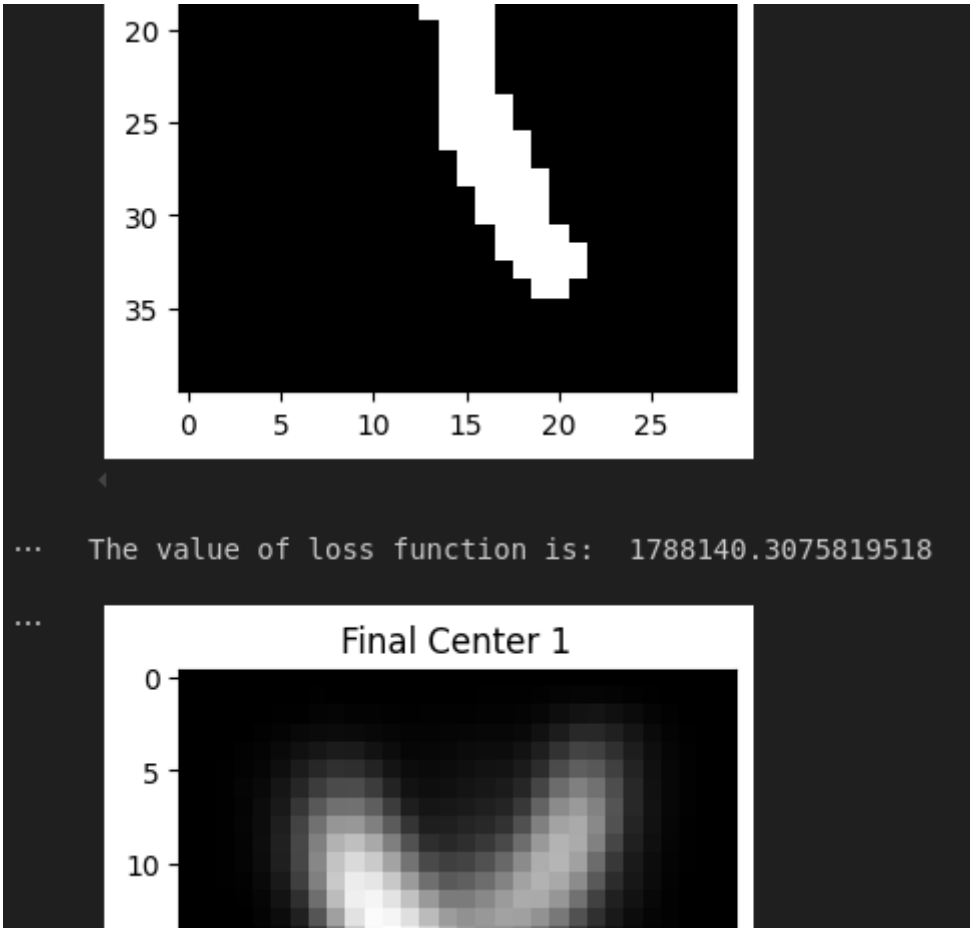
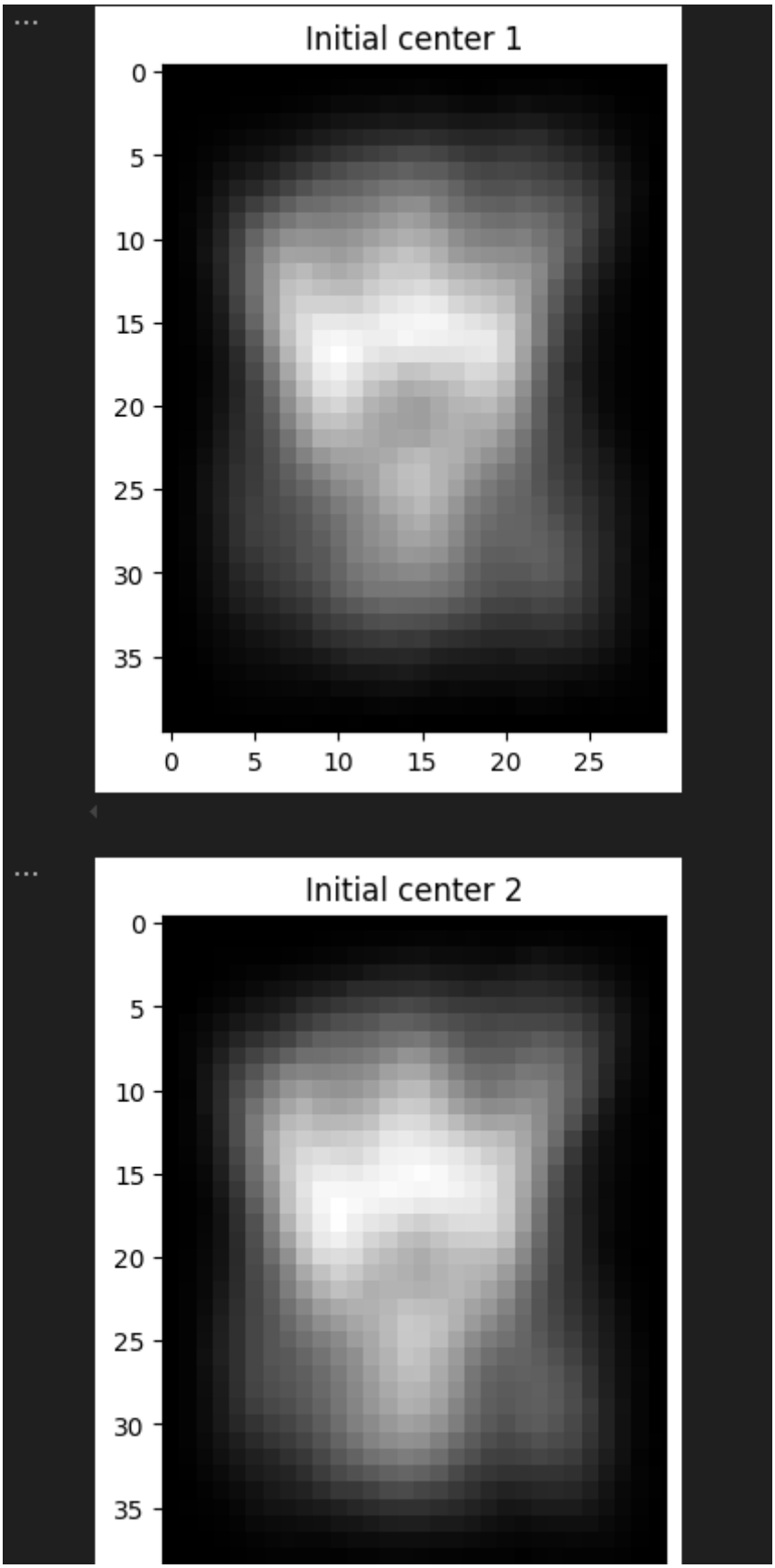
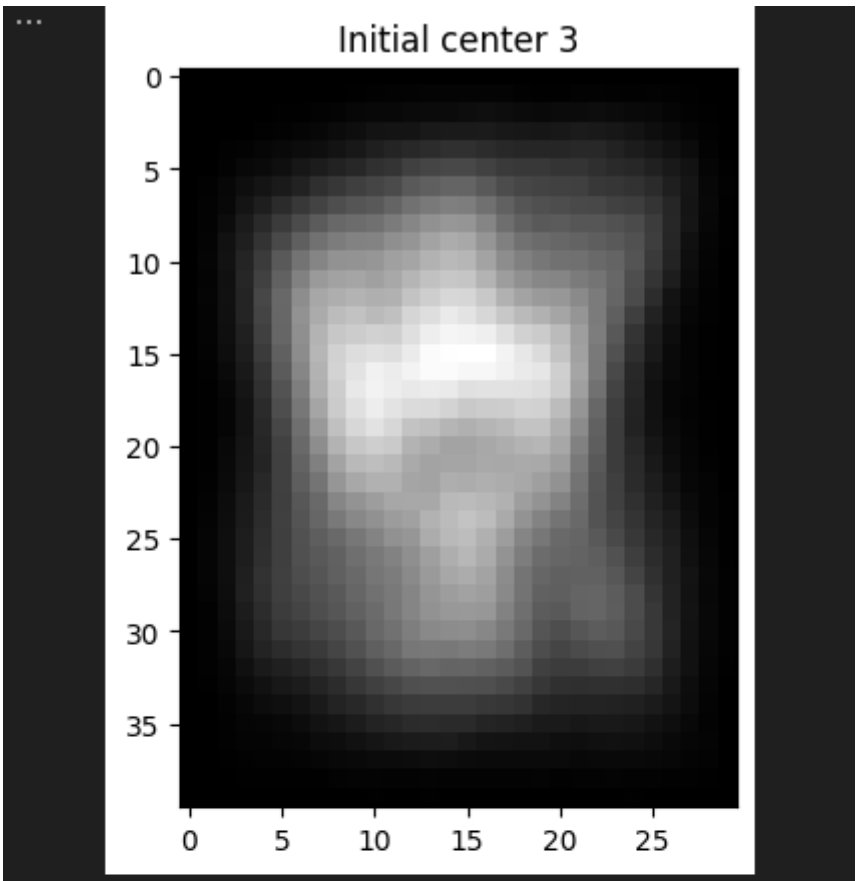
مقدار تابع هزینه



a.III:

شاخص های اولیه به صورت میانگین هر بخش

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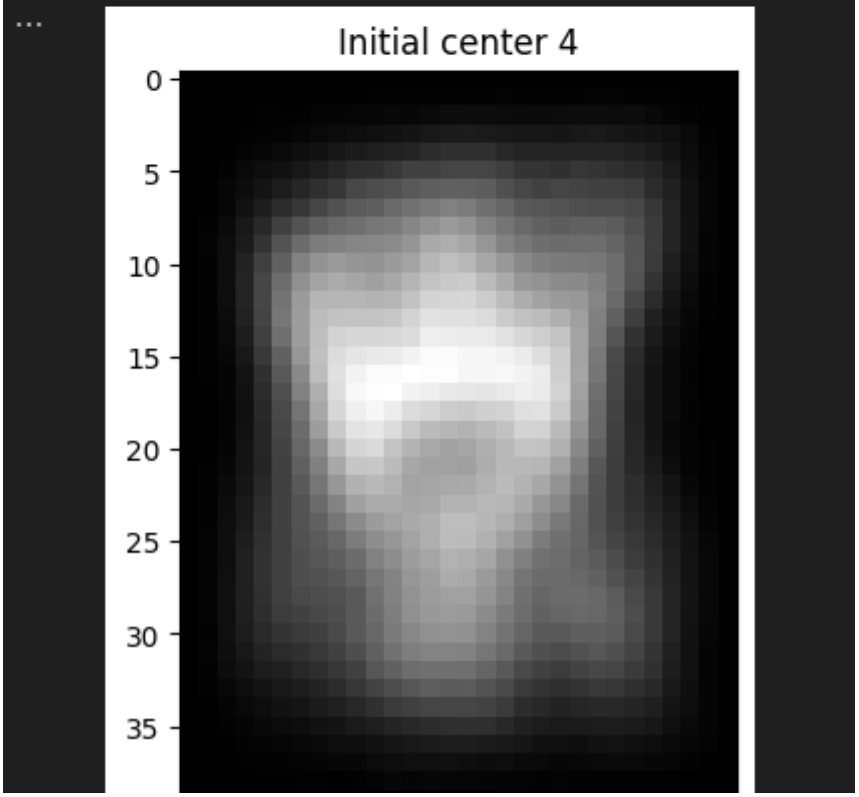
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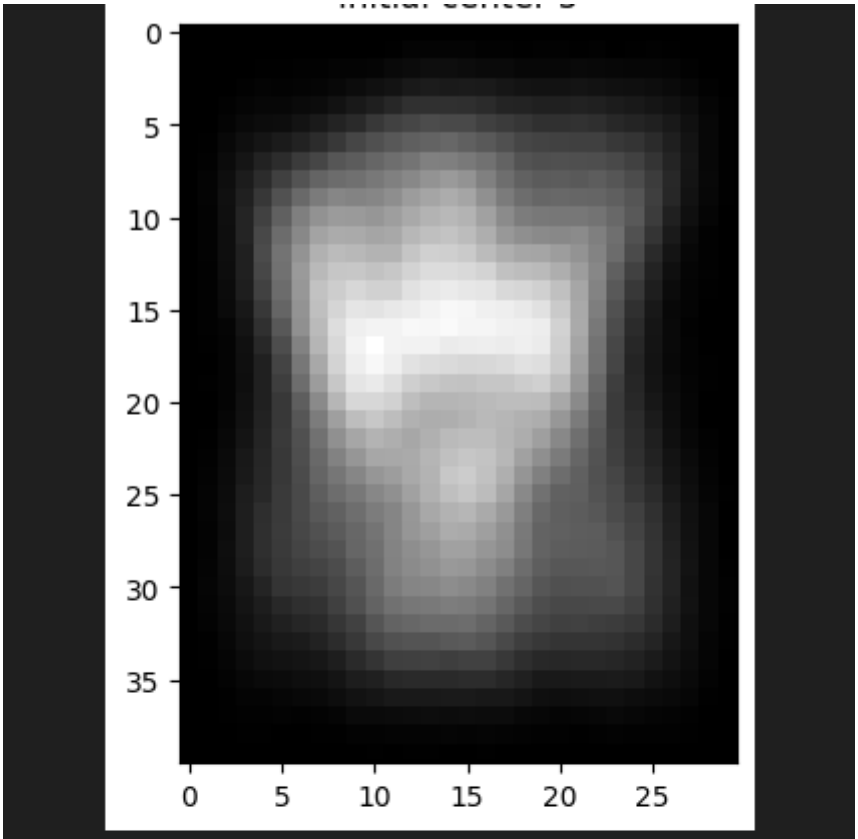
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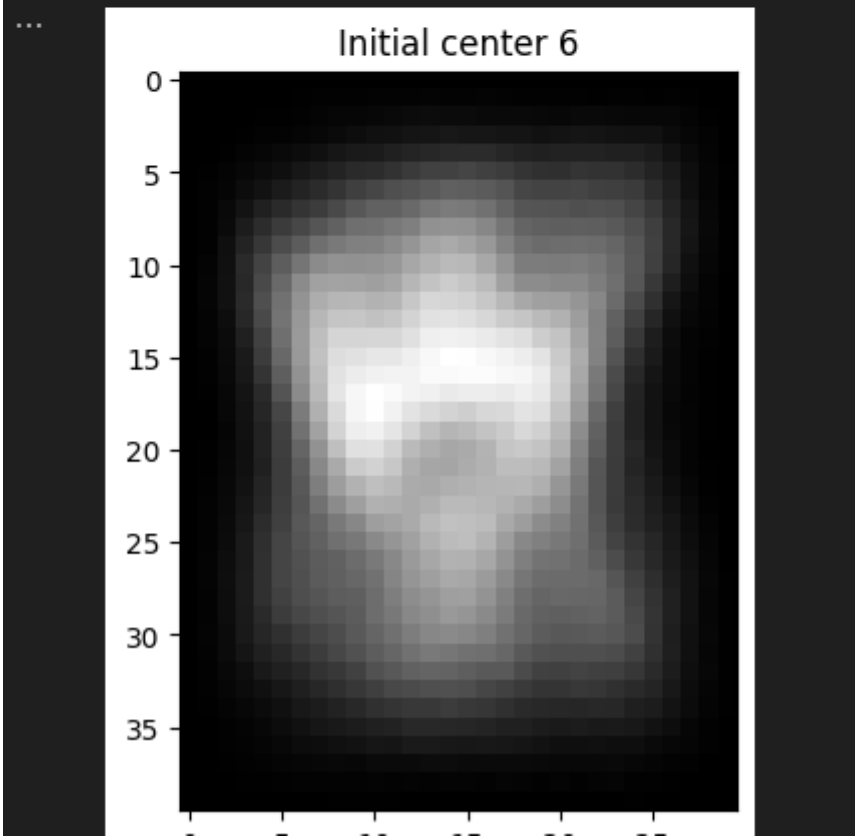
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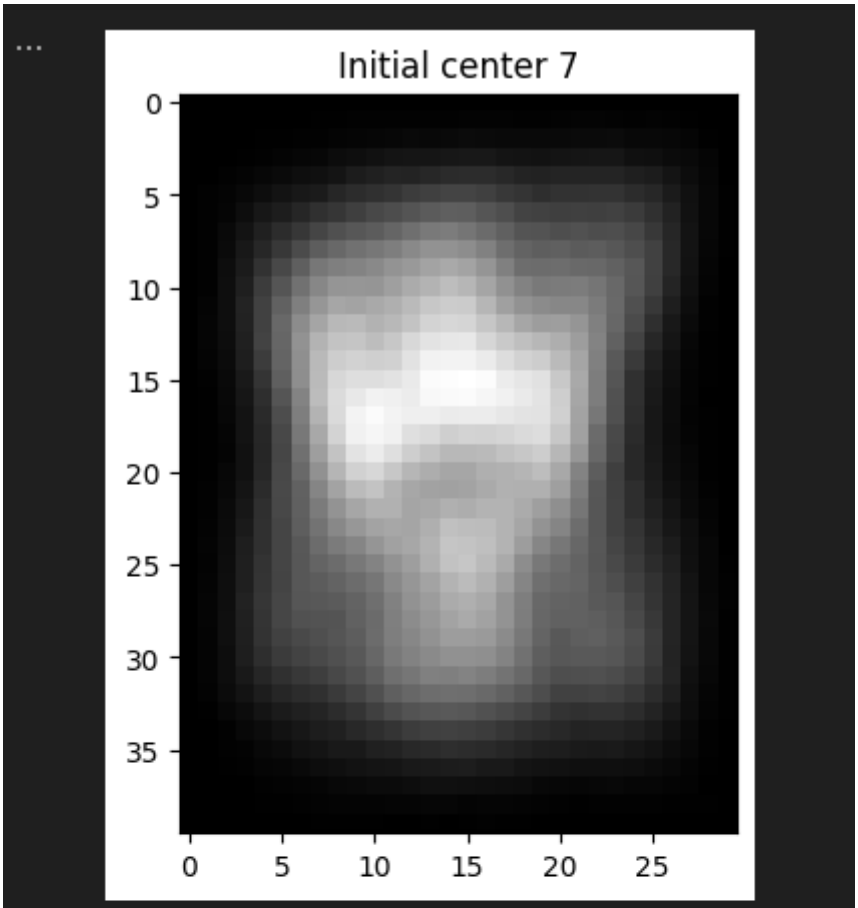
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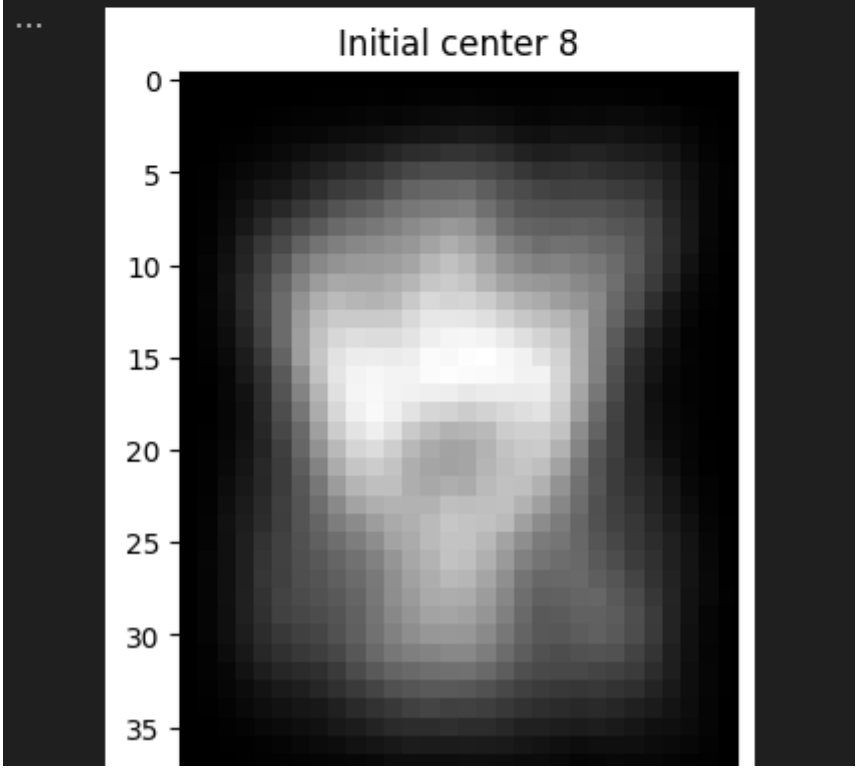
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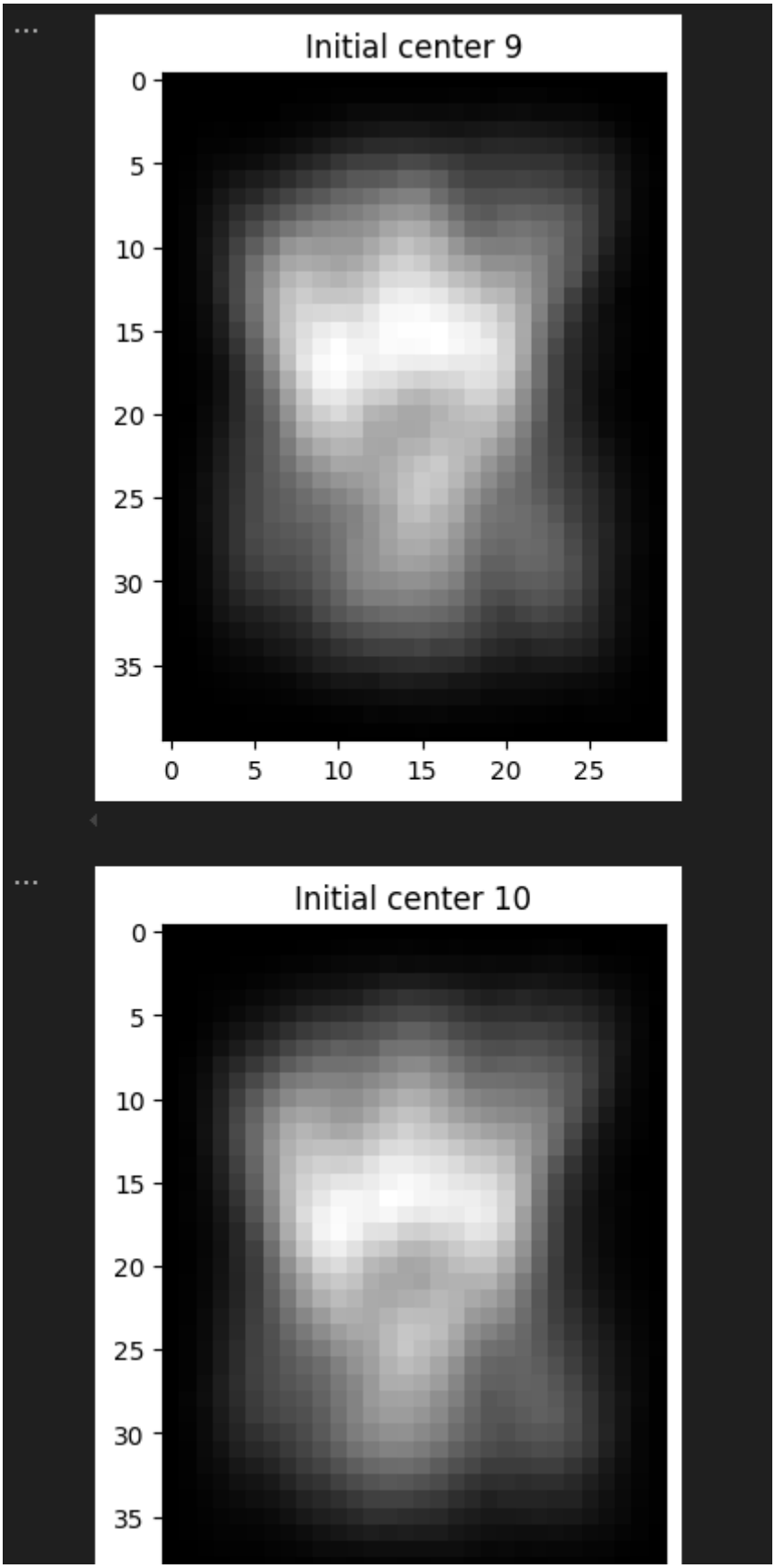
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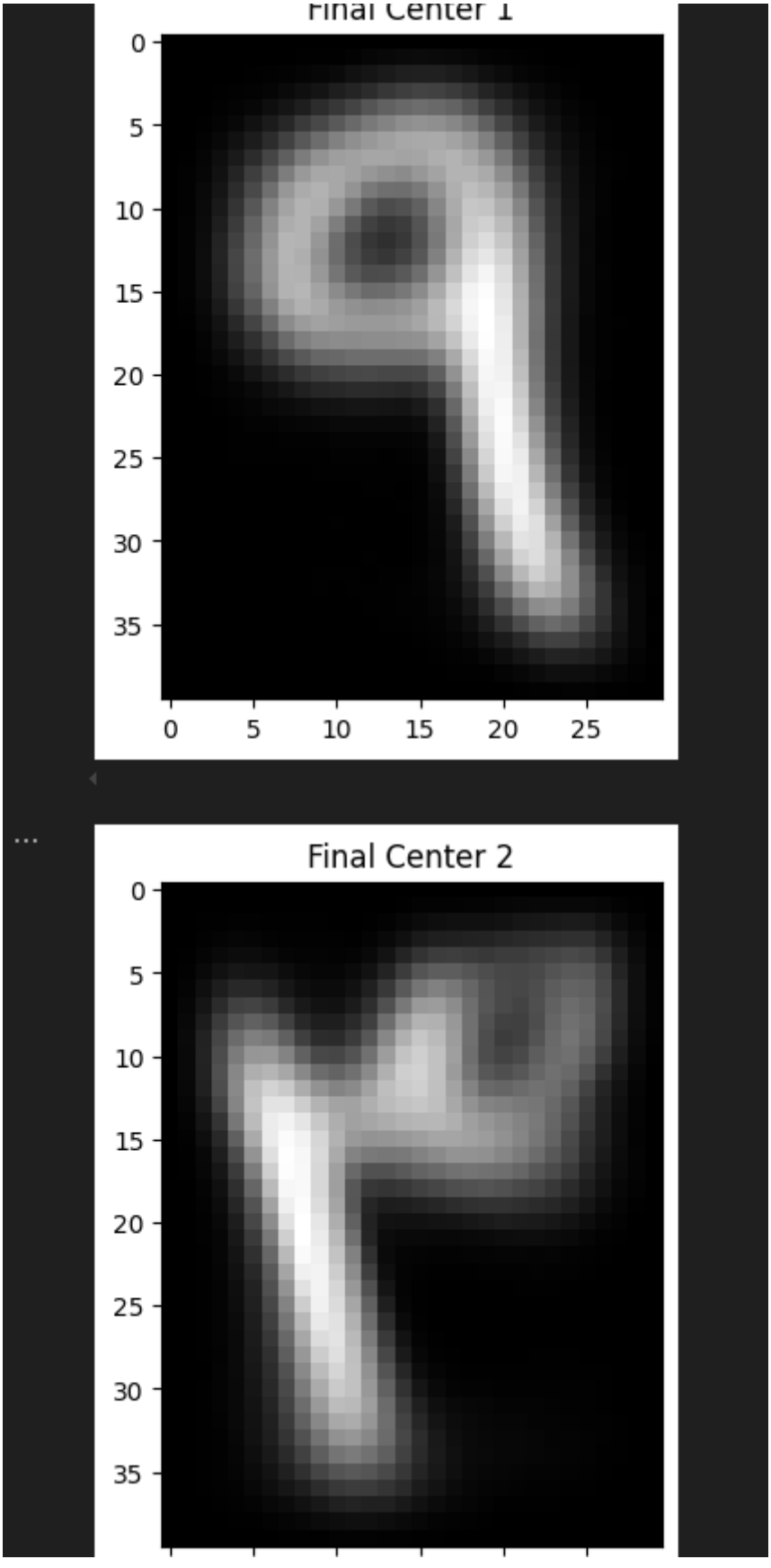
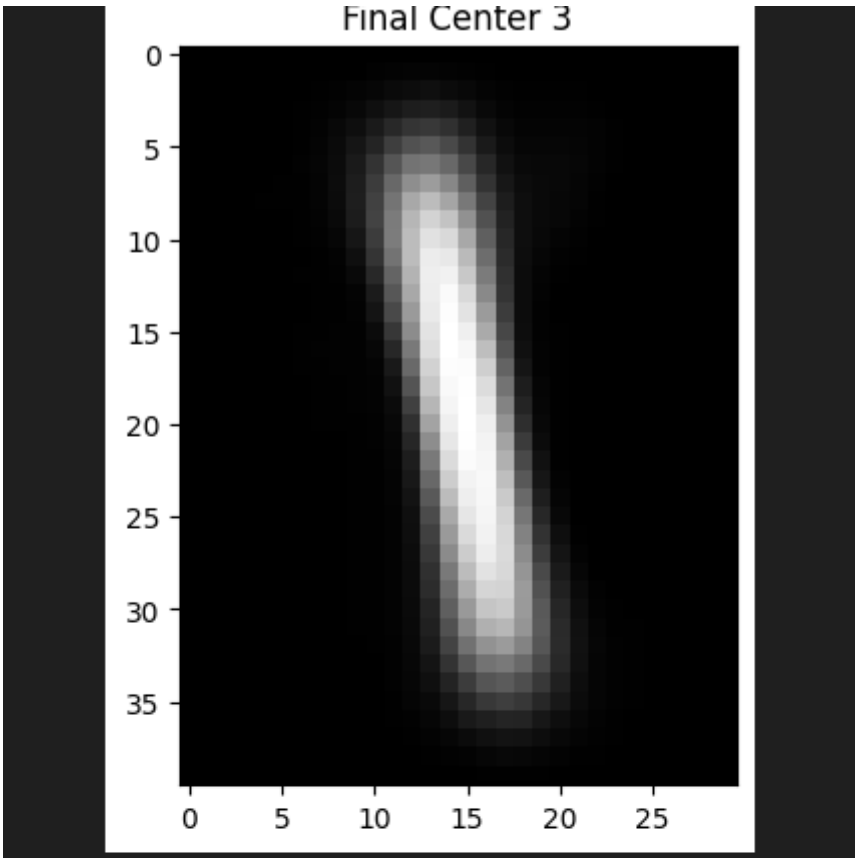
شاخص های نهایی

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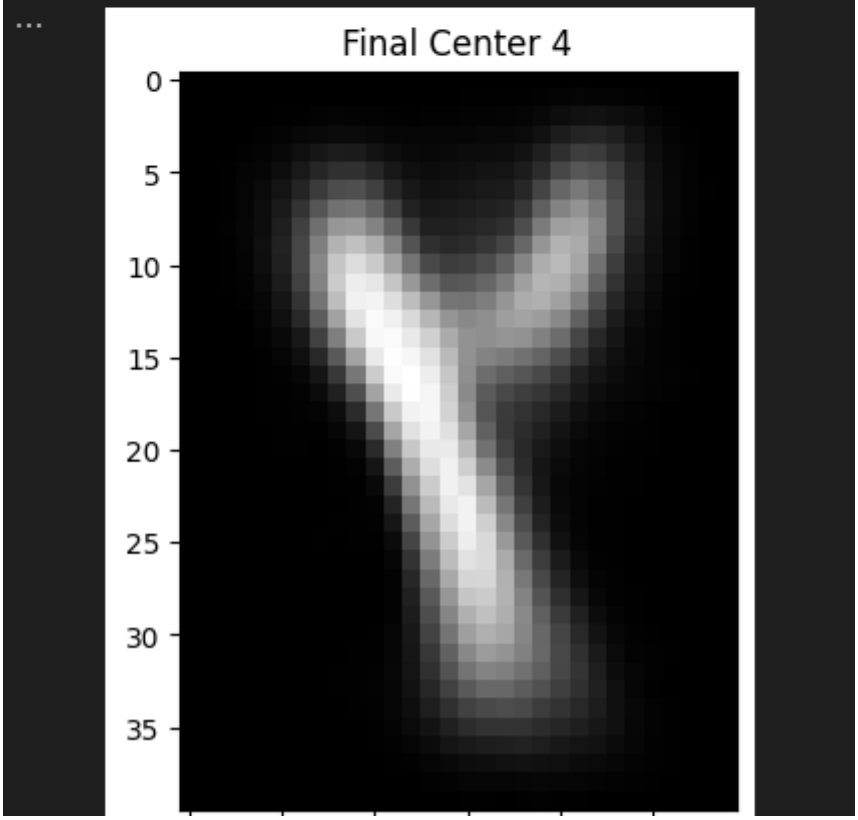
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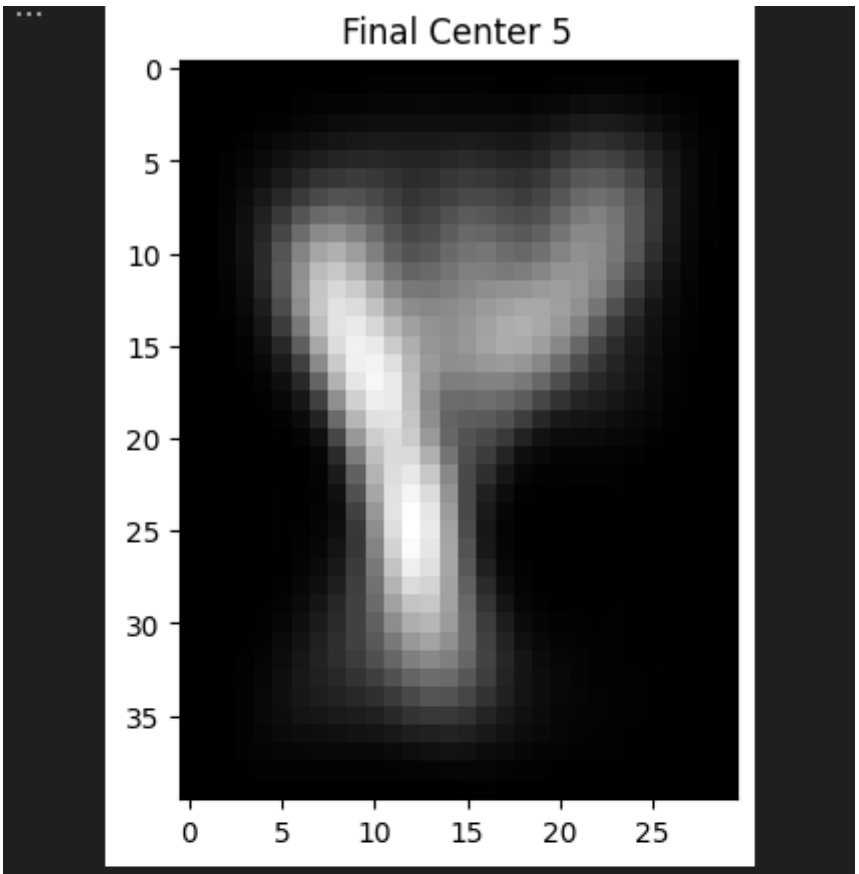
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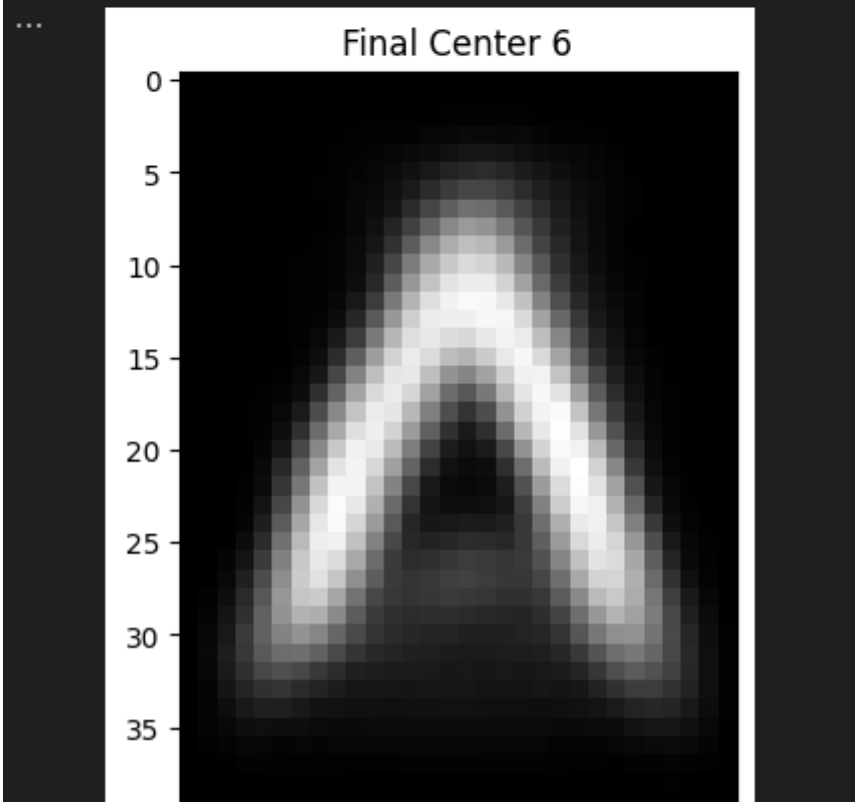
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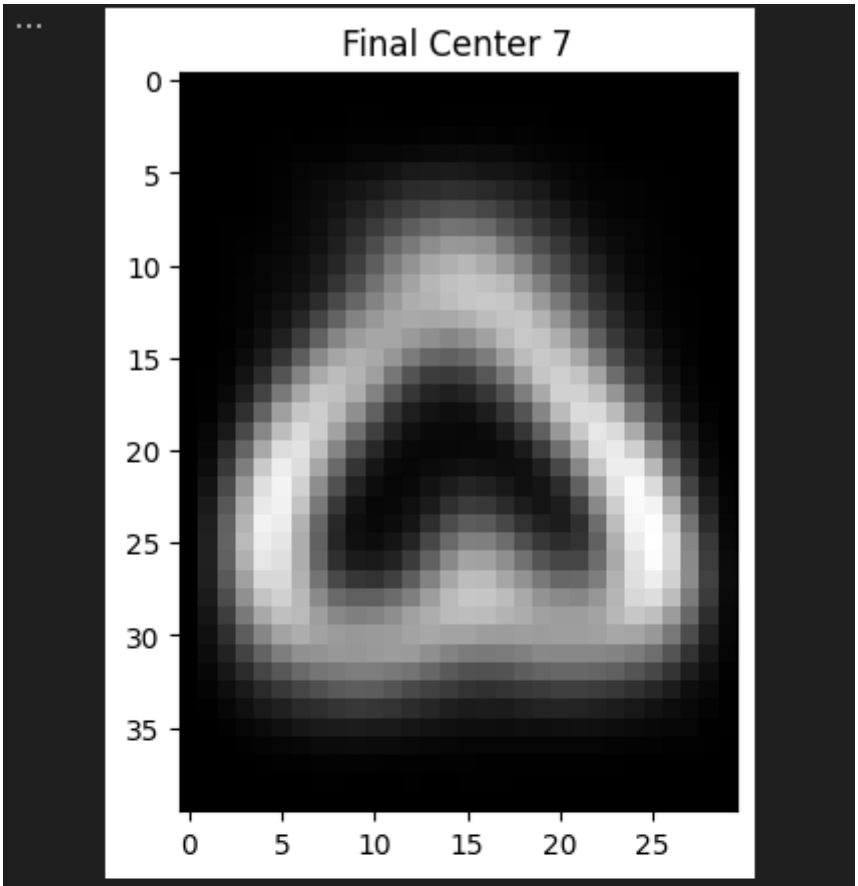
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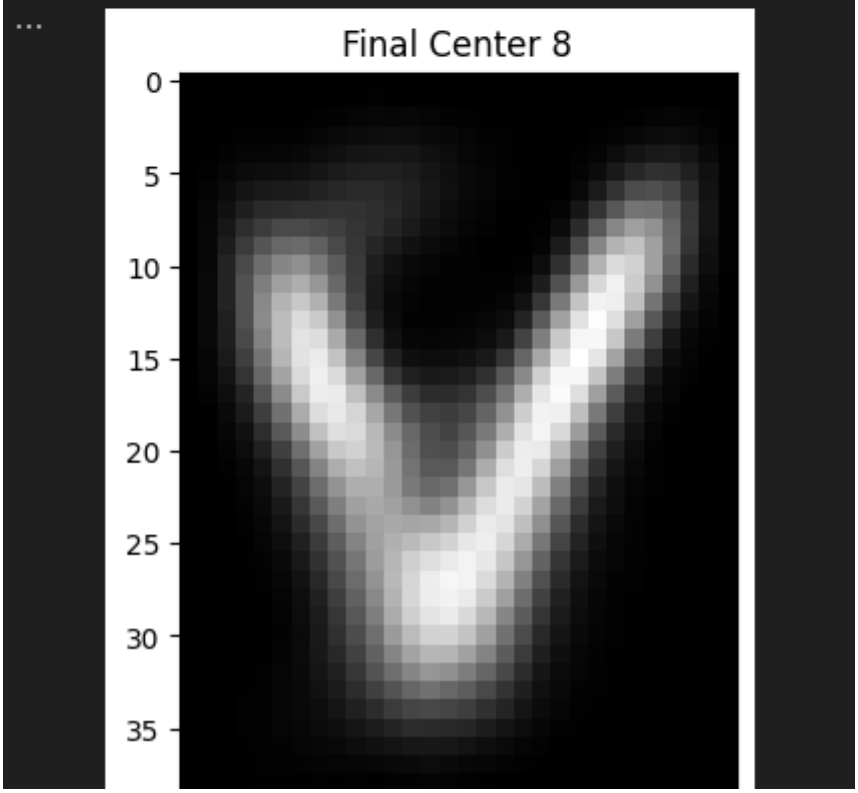
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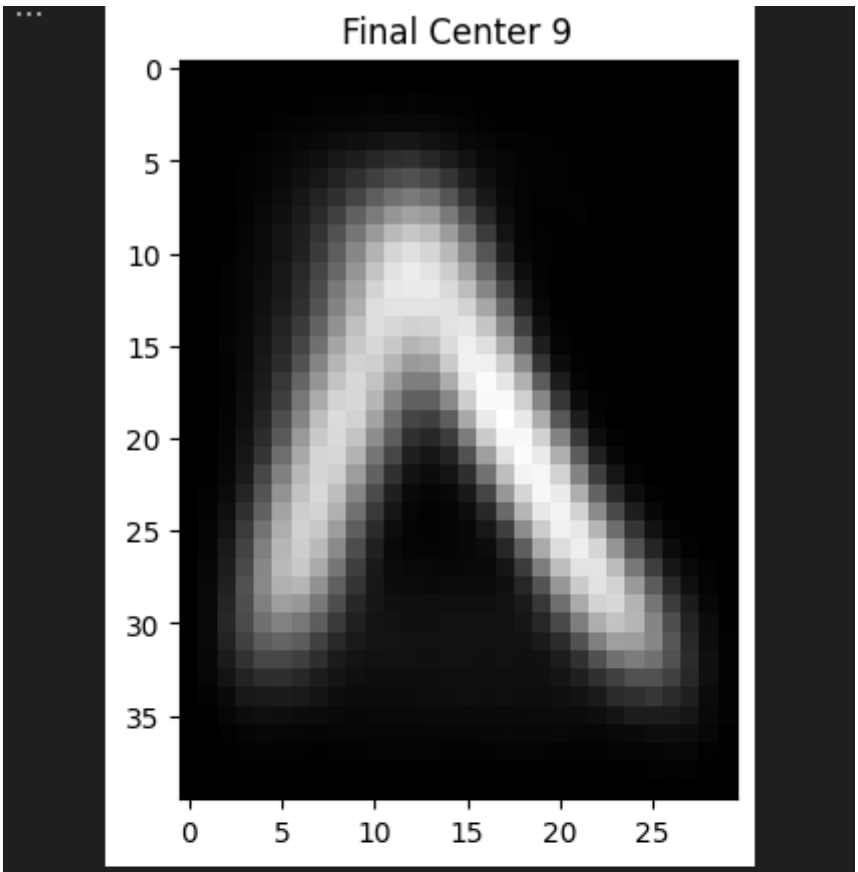
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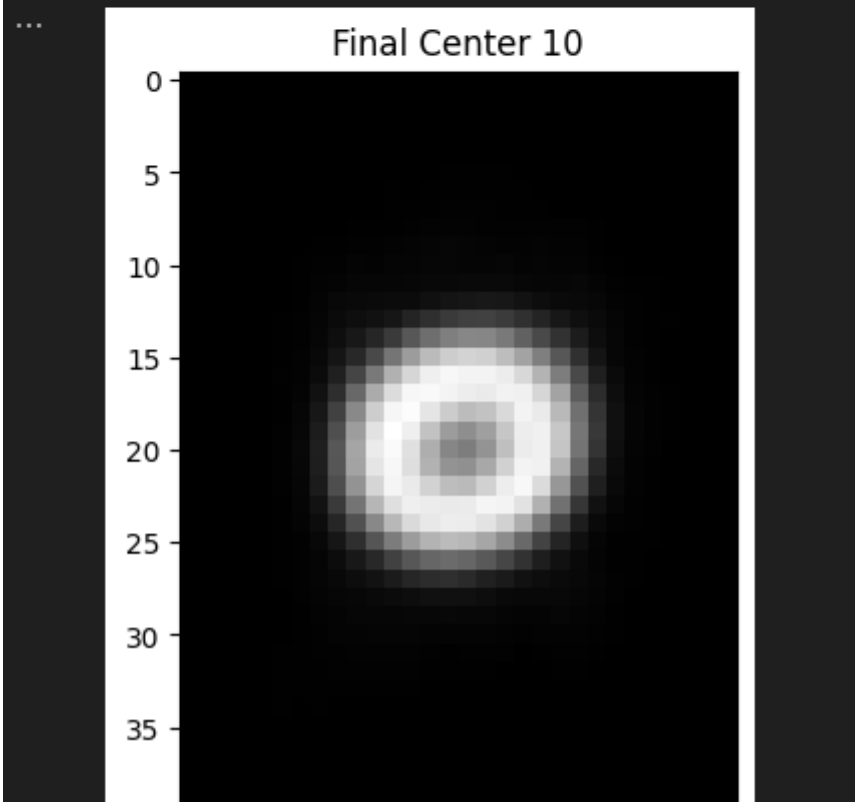
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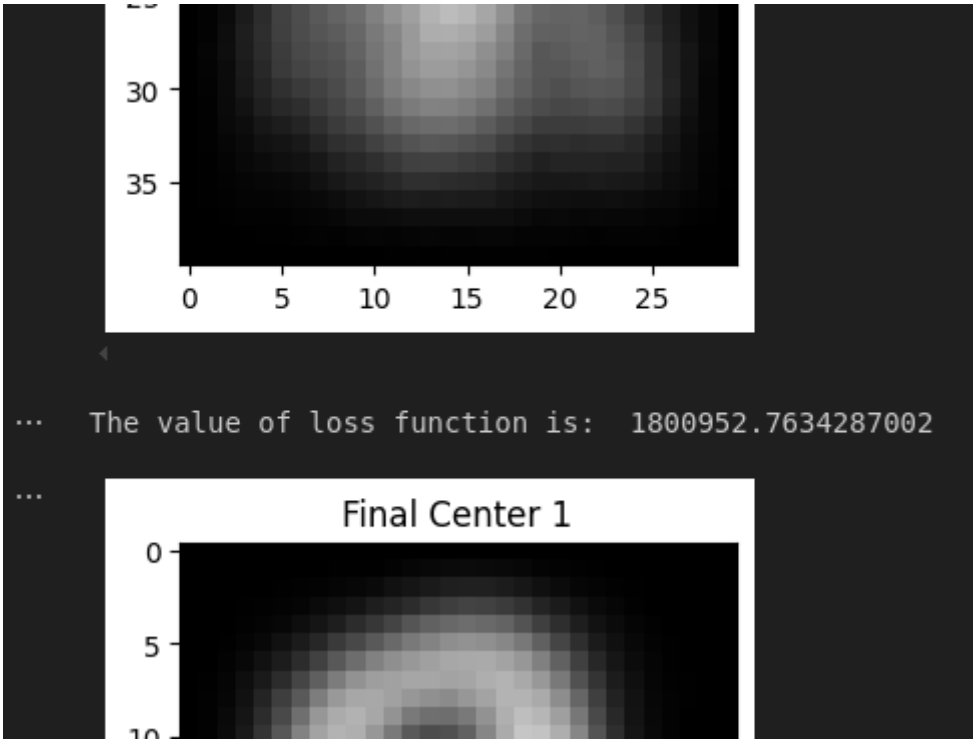
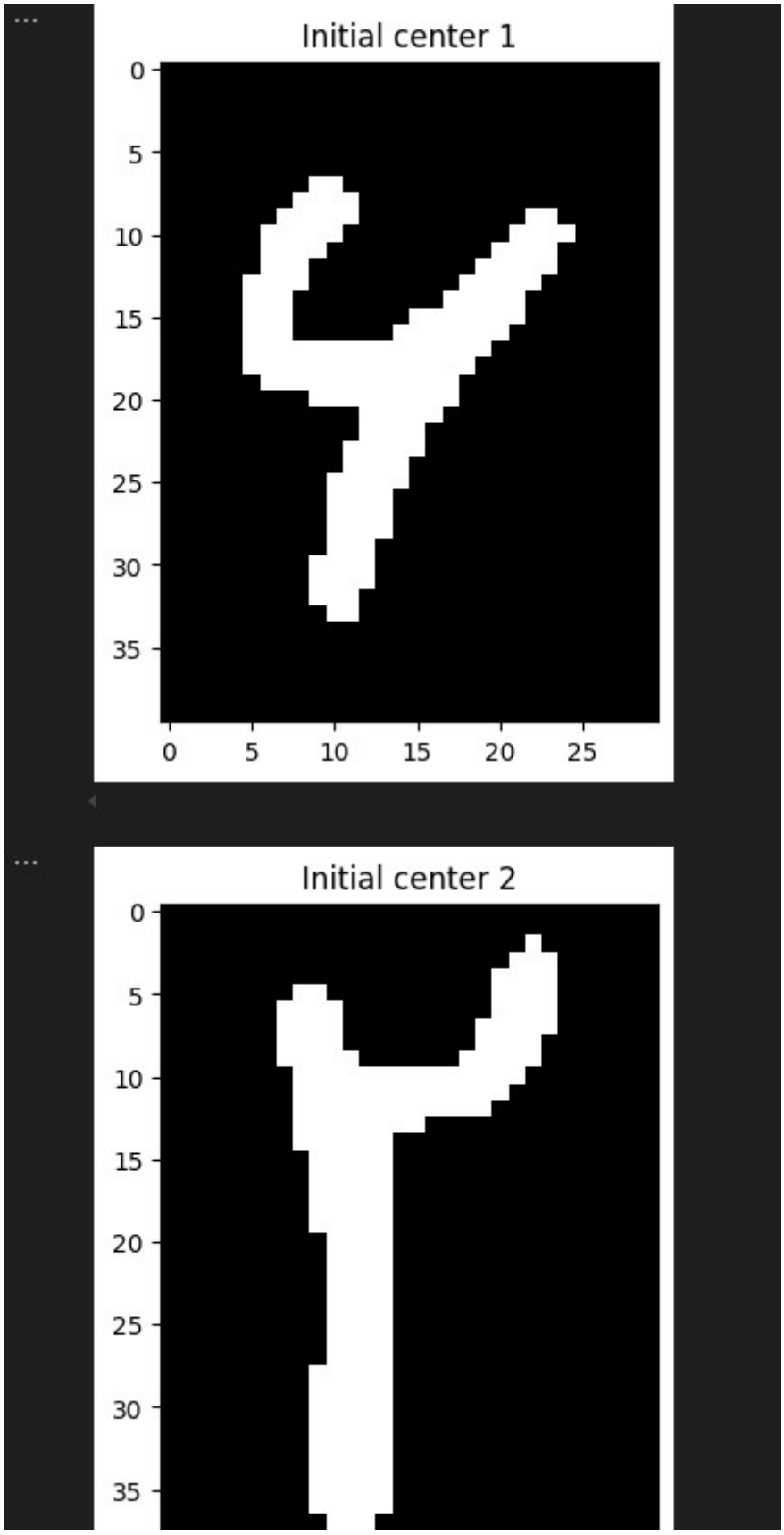
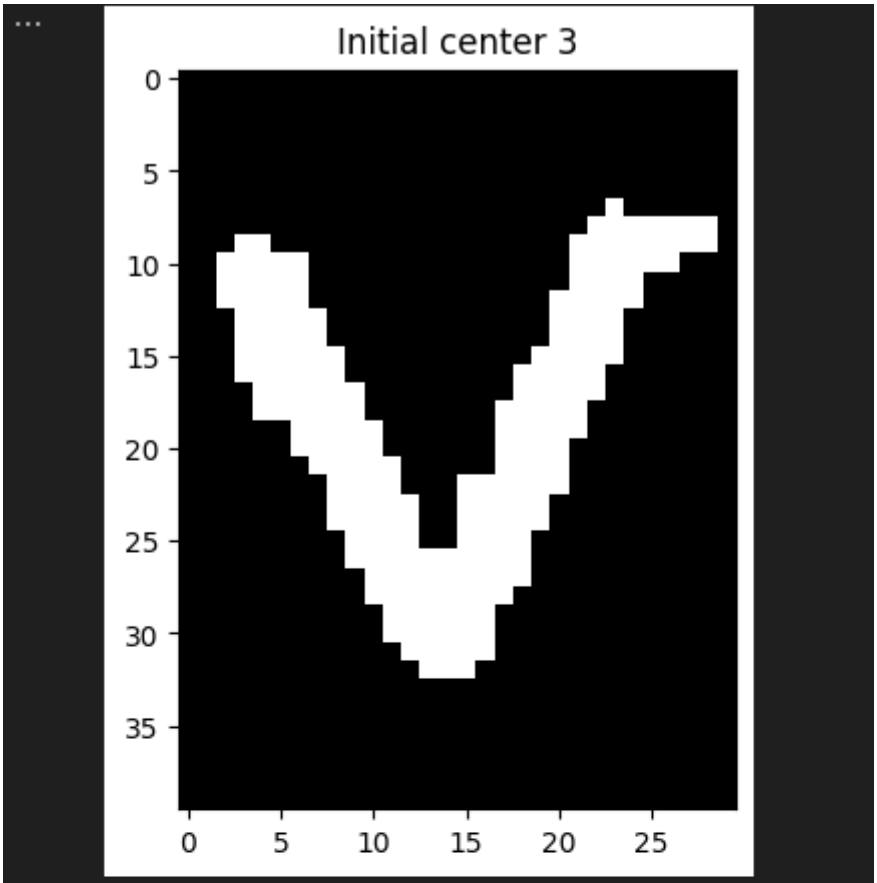
مقدار تابع هزینه



a.IV:

شاخص های اولیه مناسب انتخاب شده از بین ۱۰۰ داده اول

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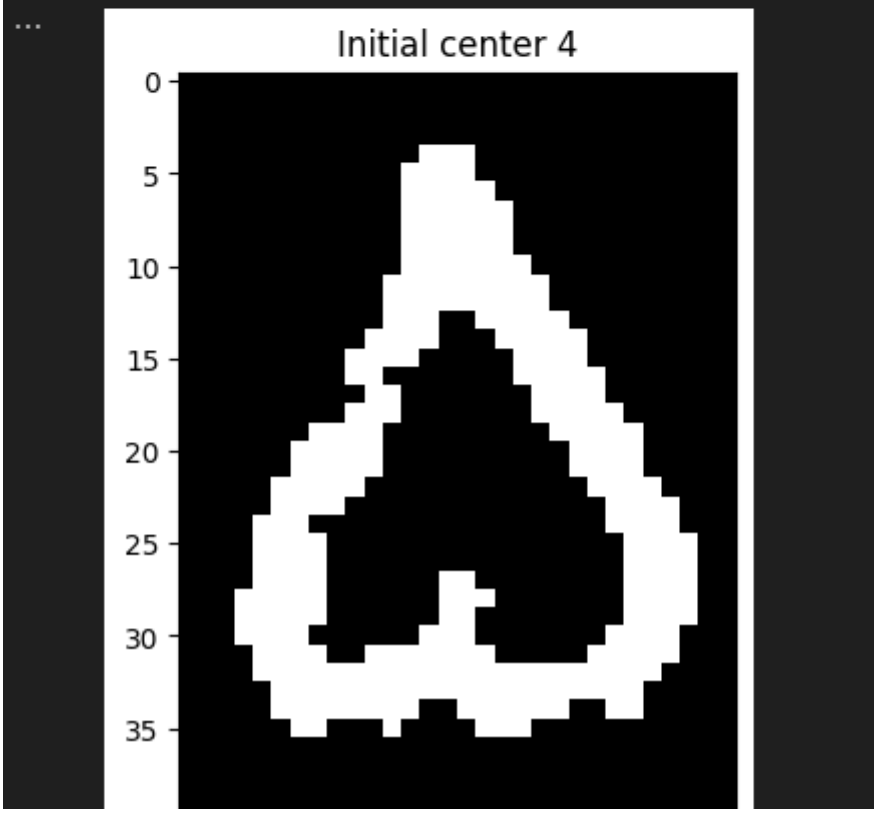
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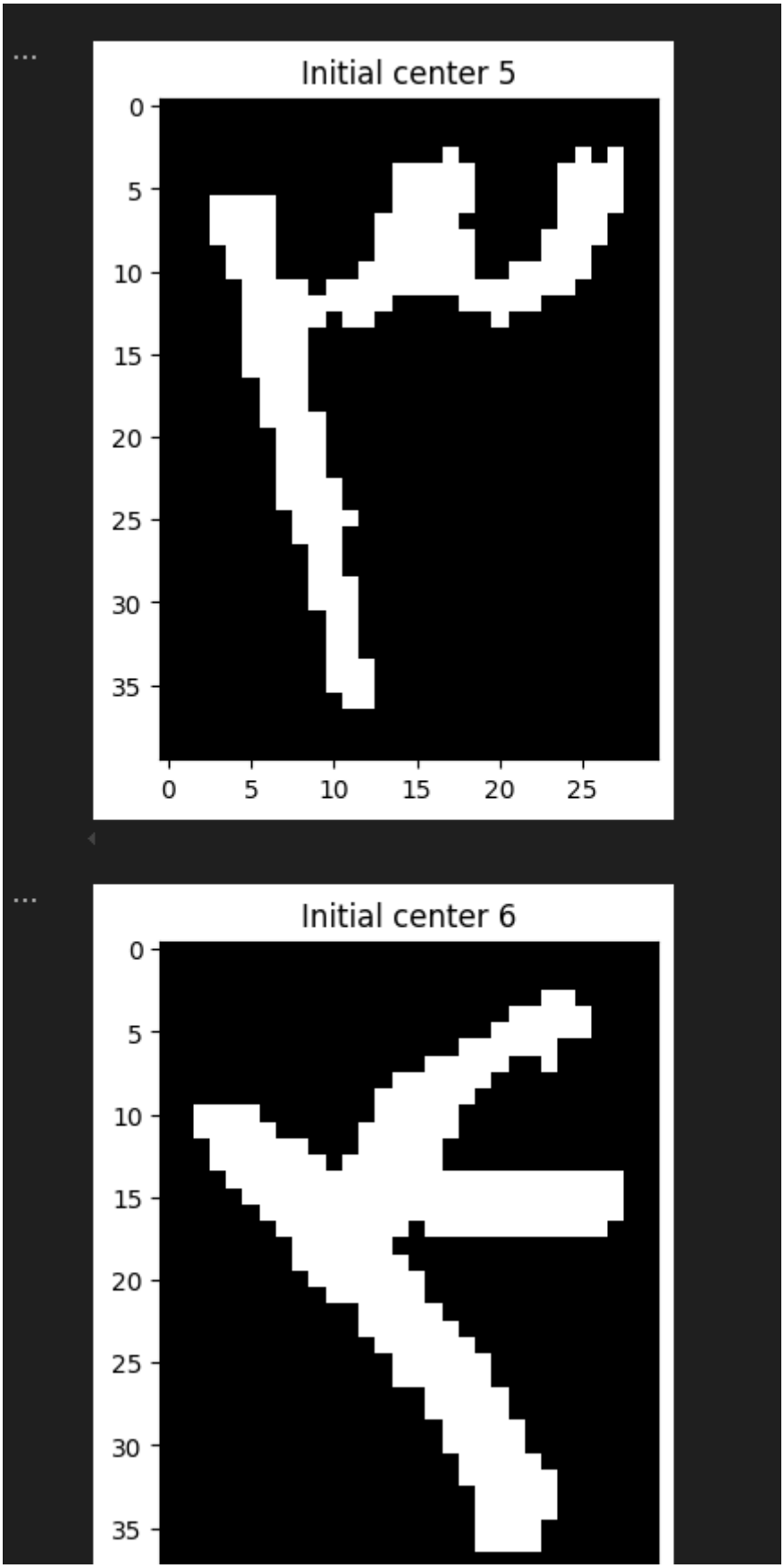
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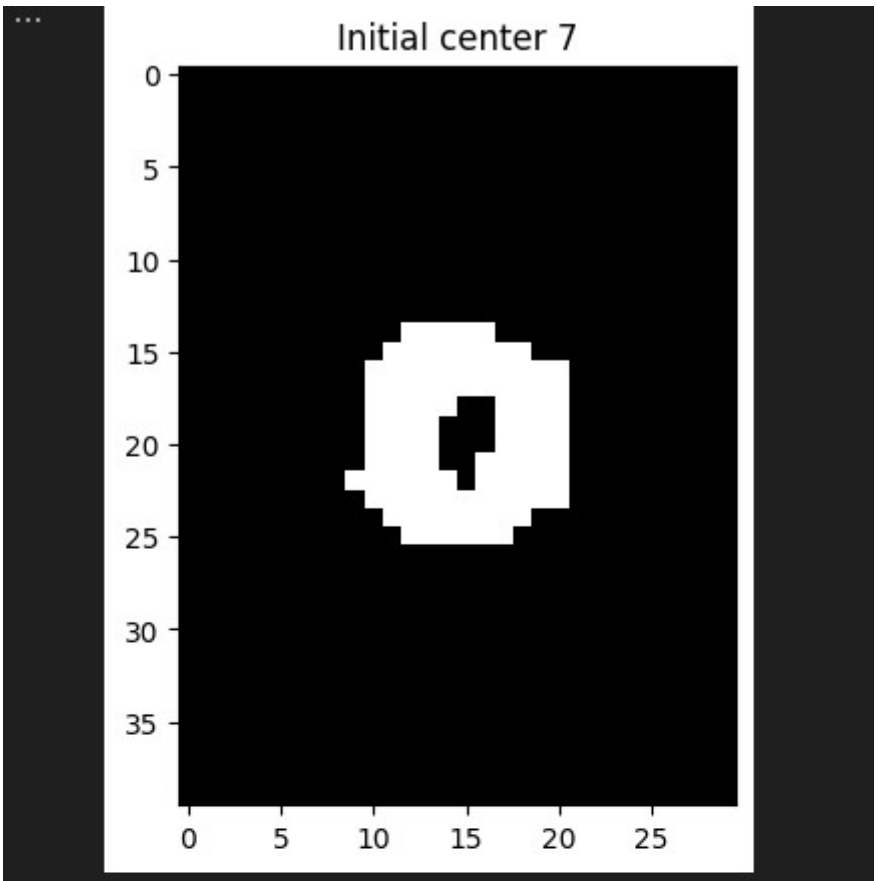
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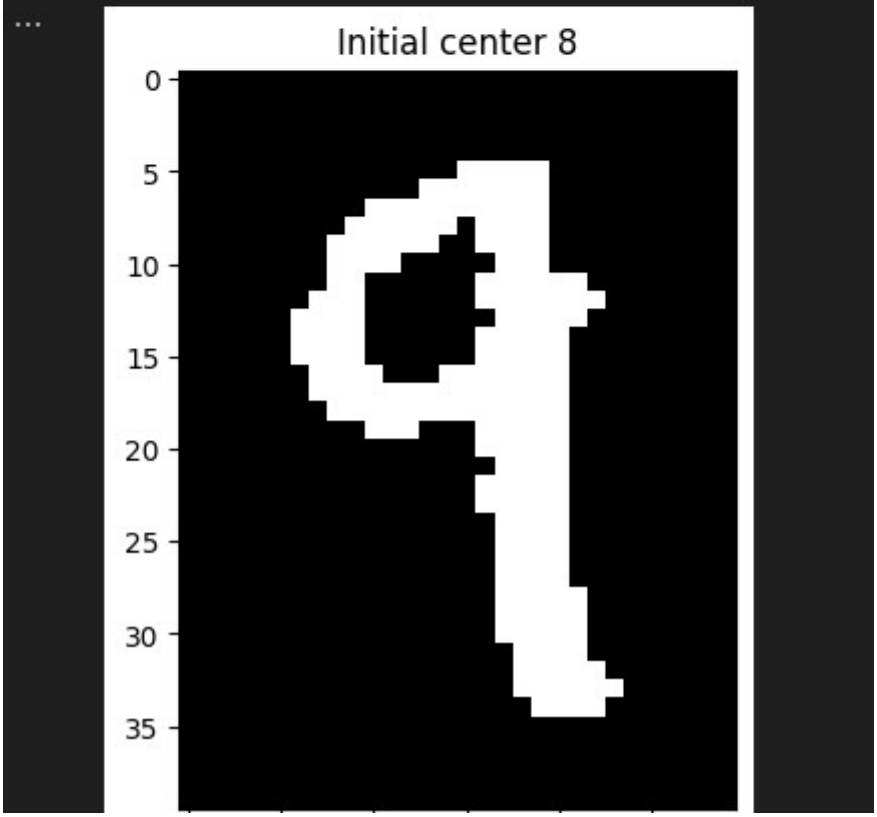
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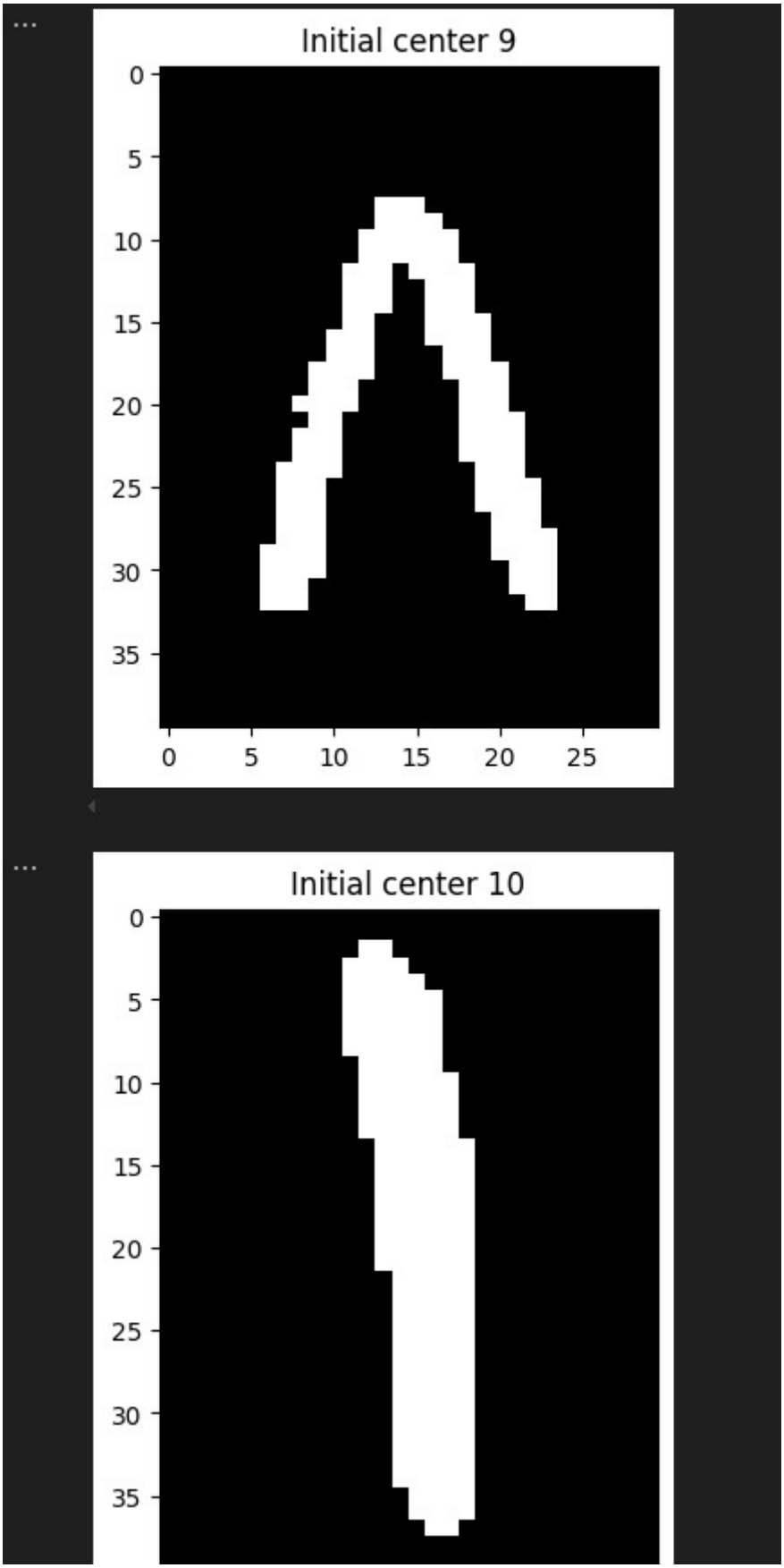
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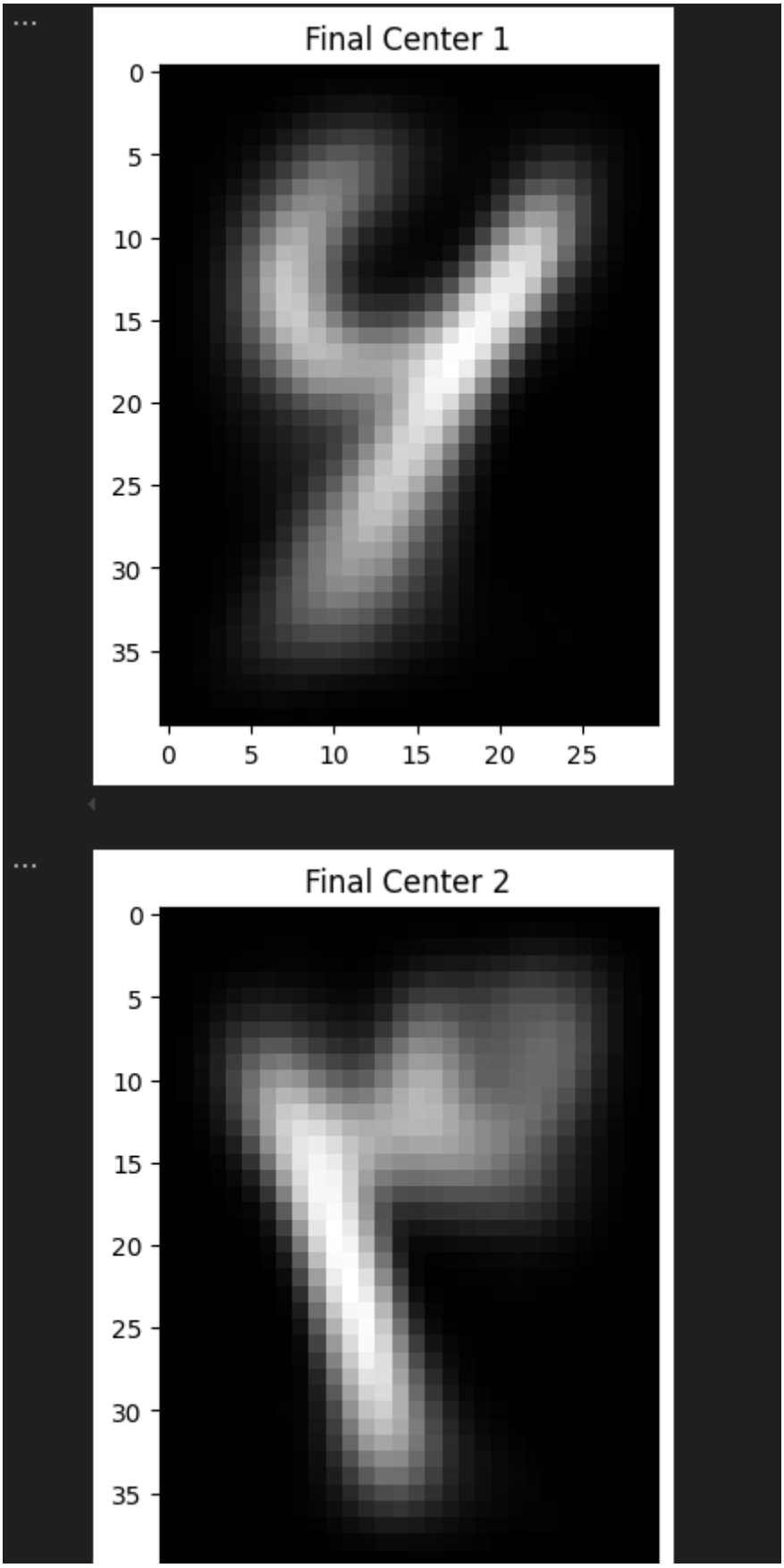
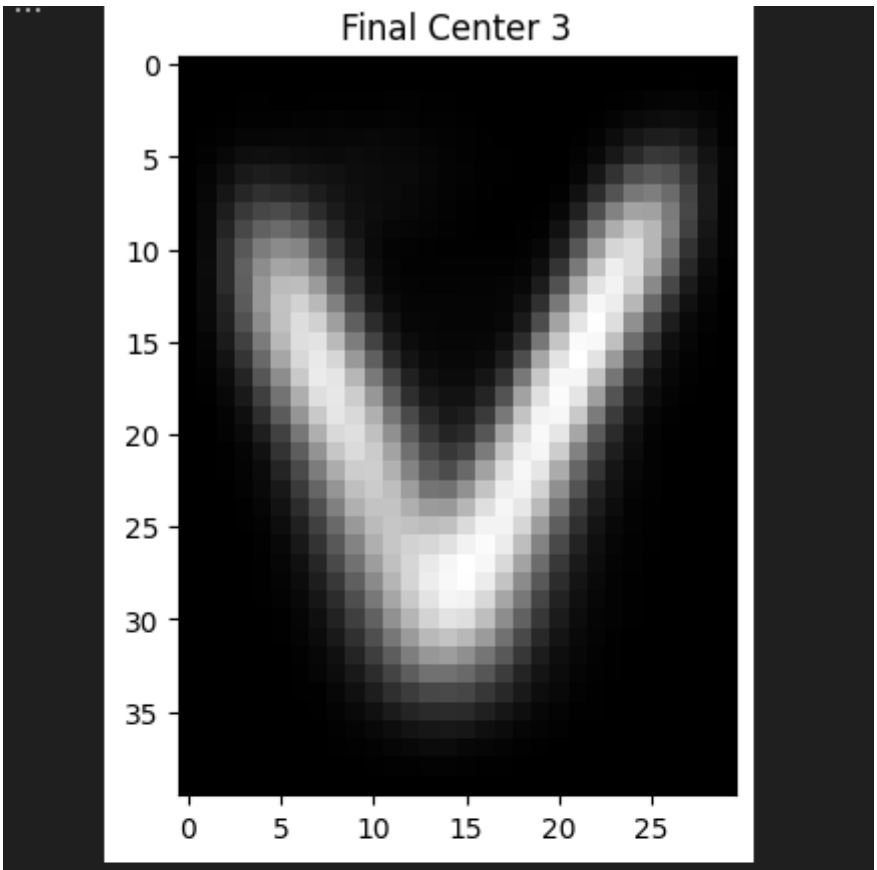
شاخص های نهایی

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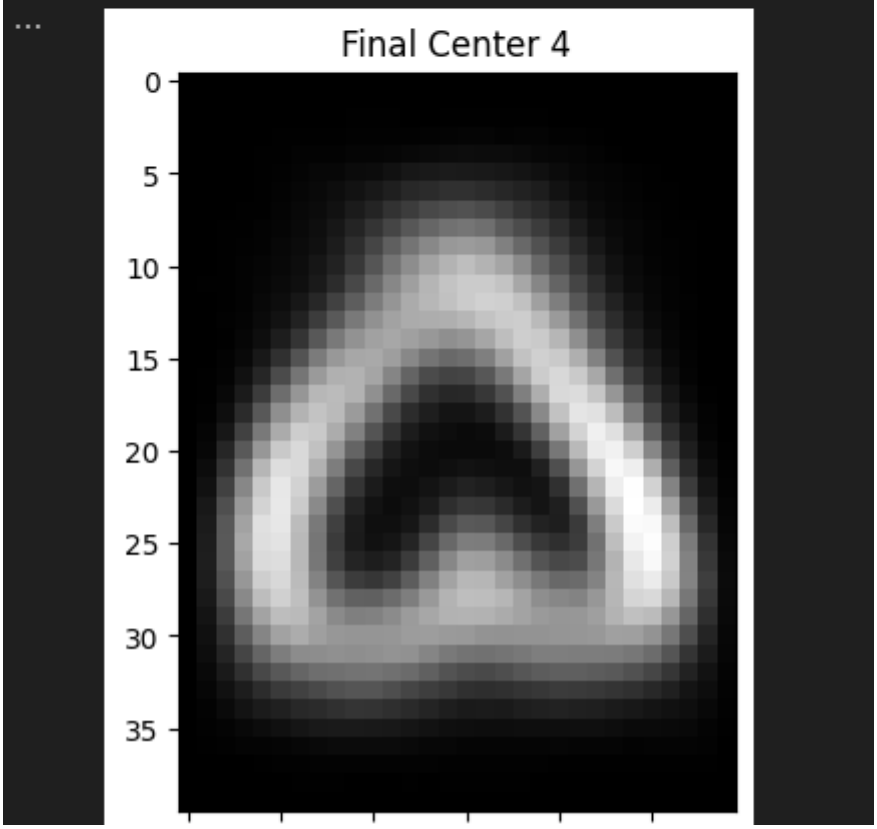
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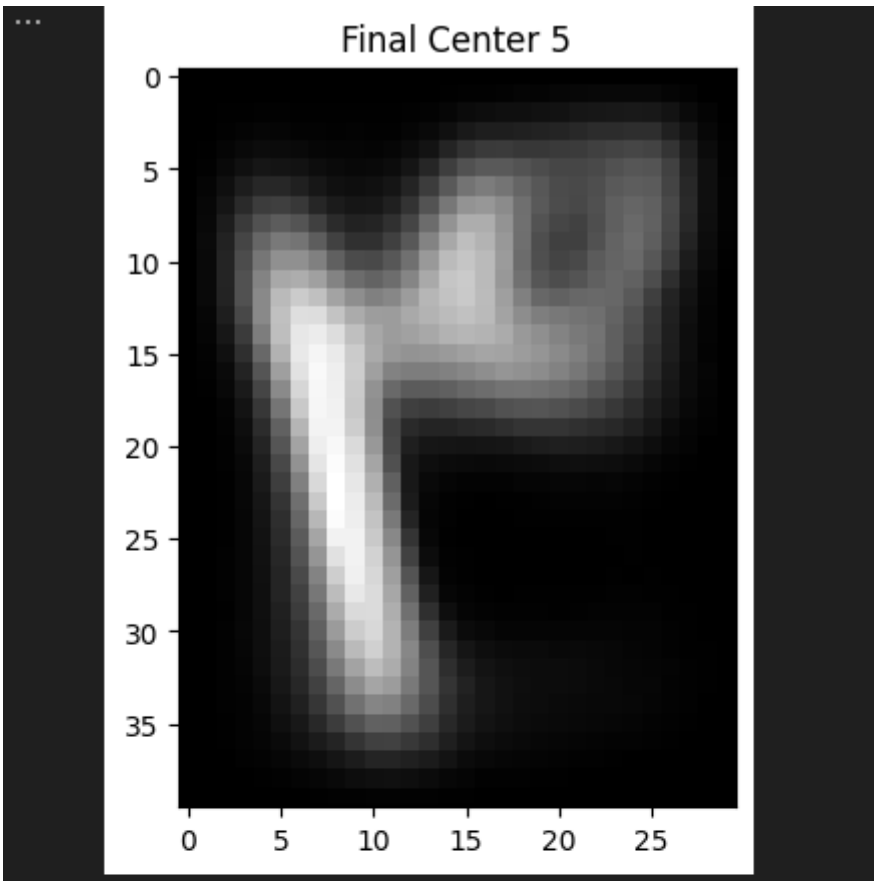
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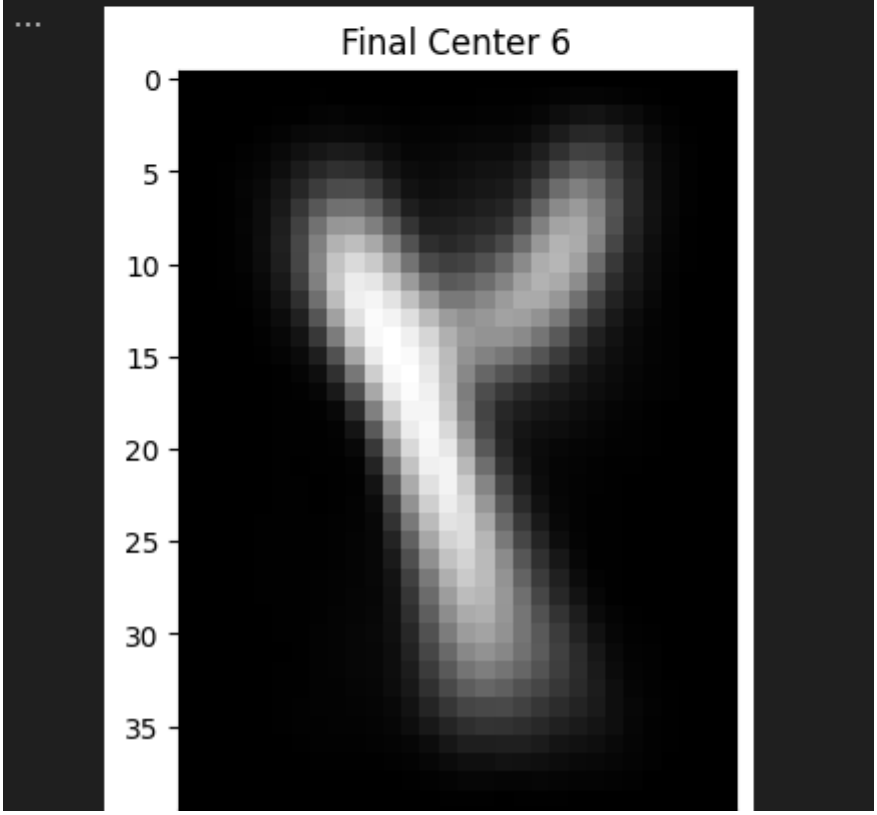
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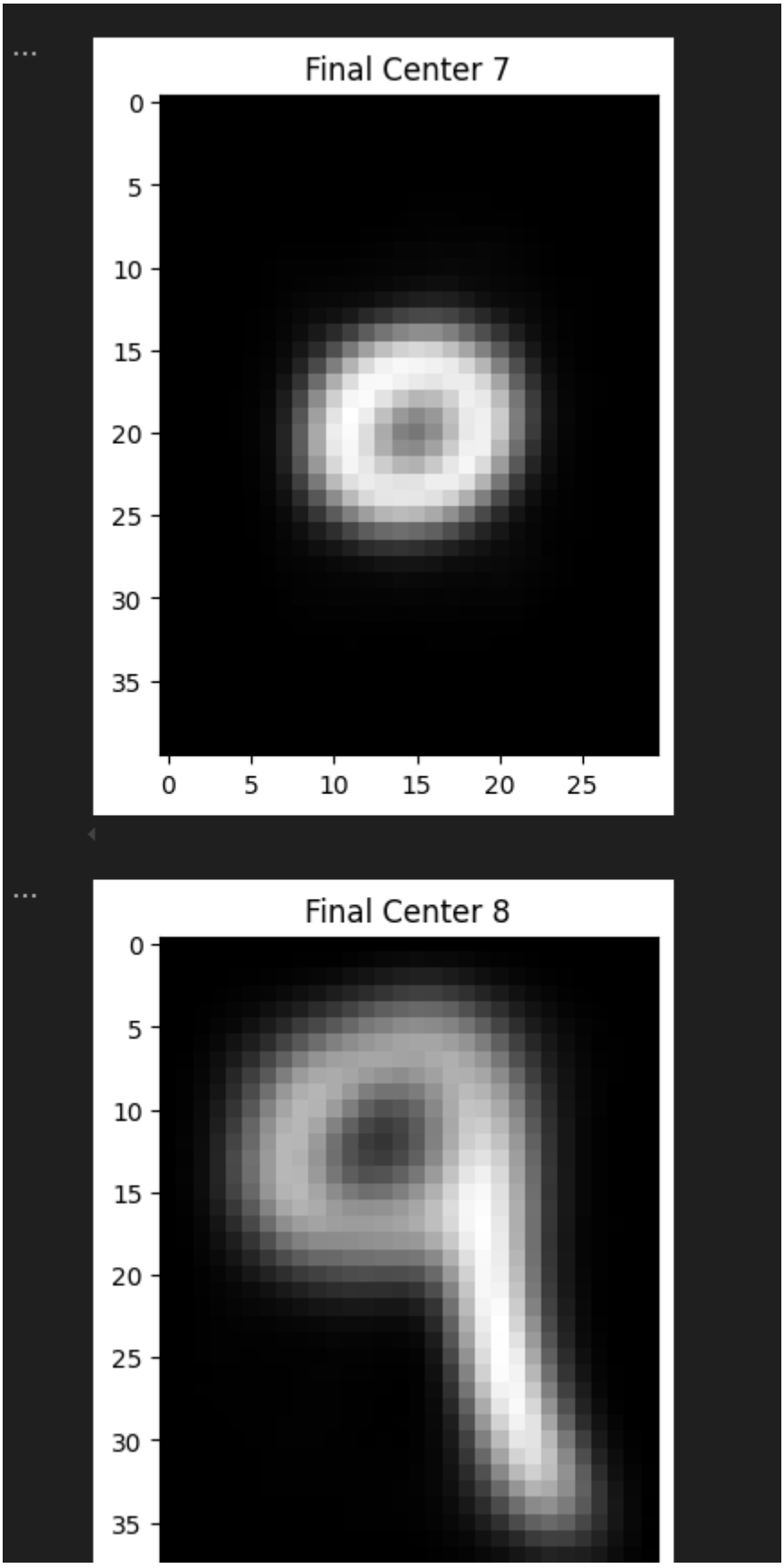
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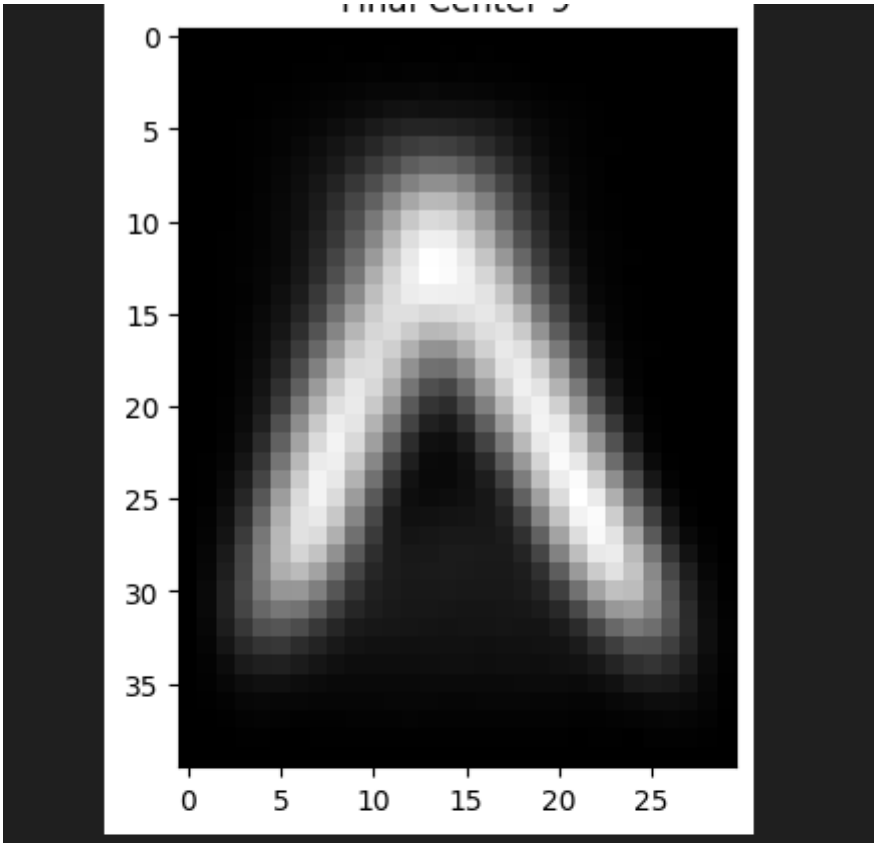
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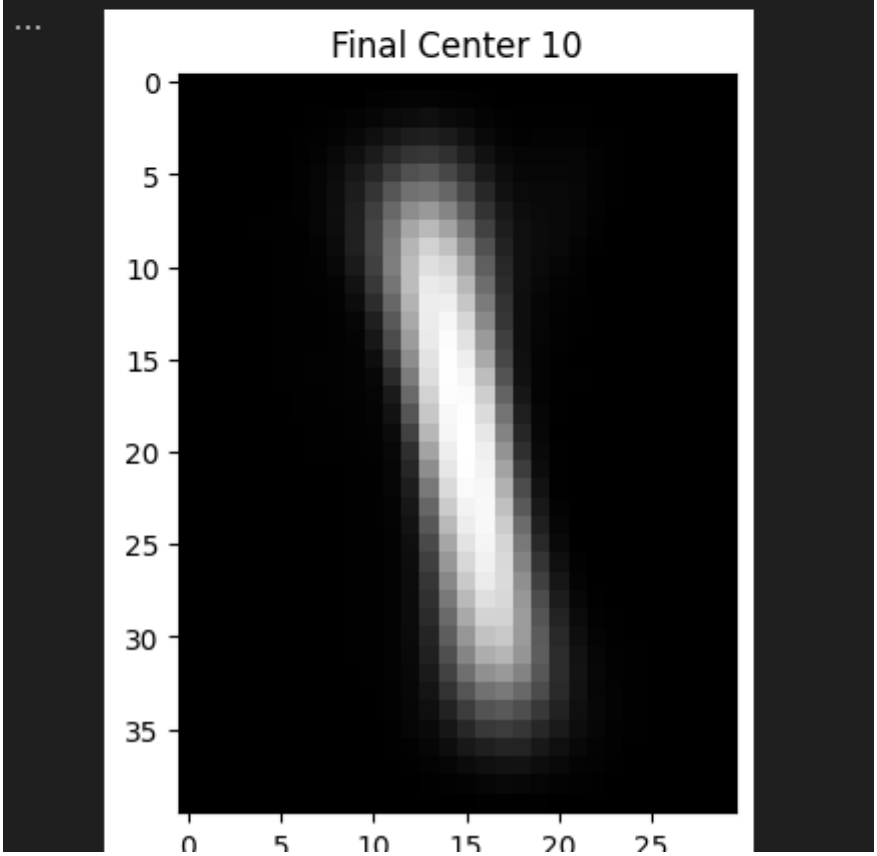
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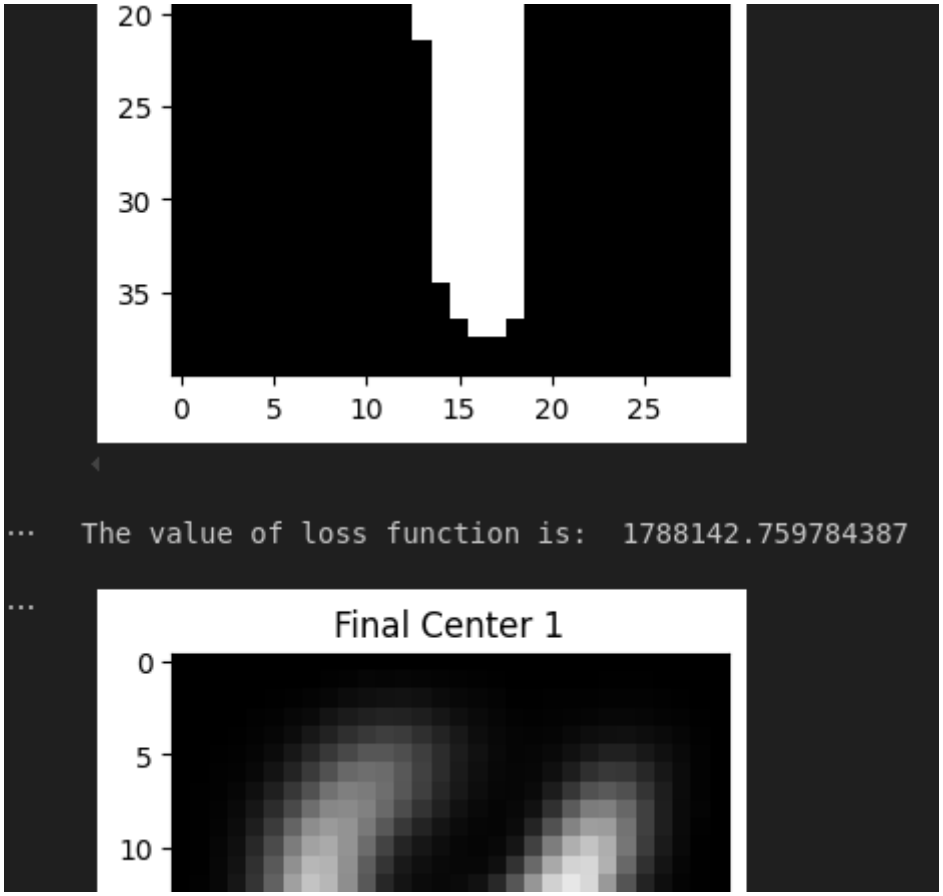
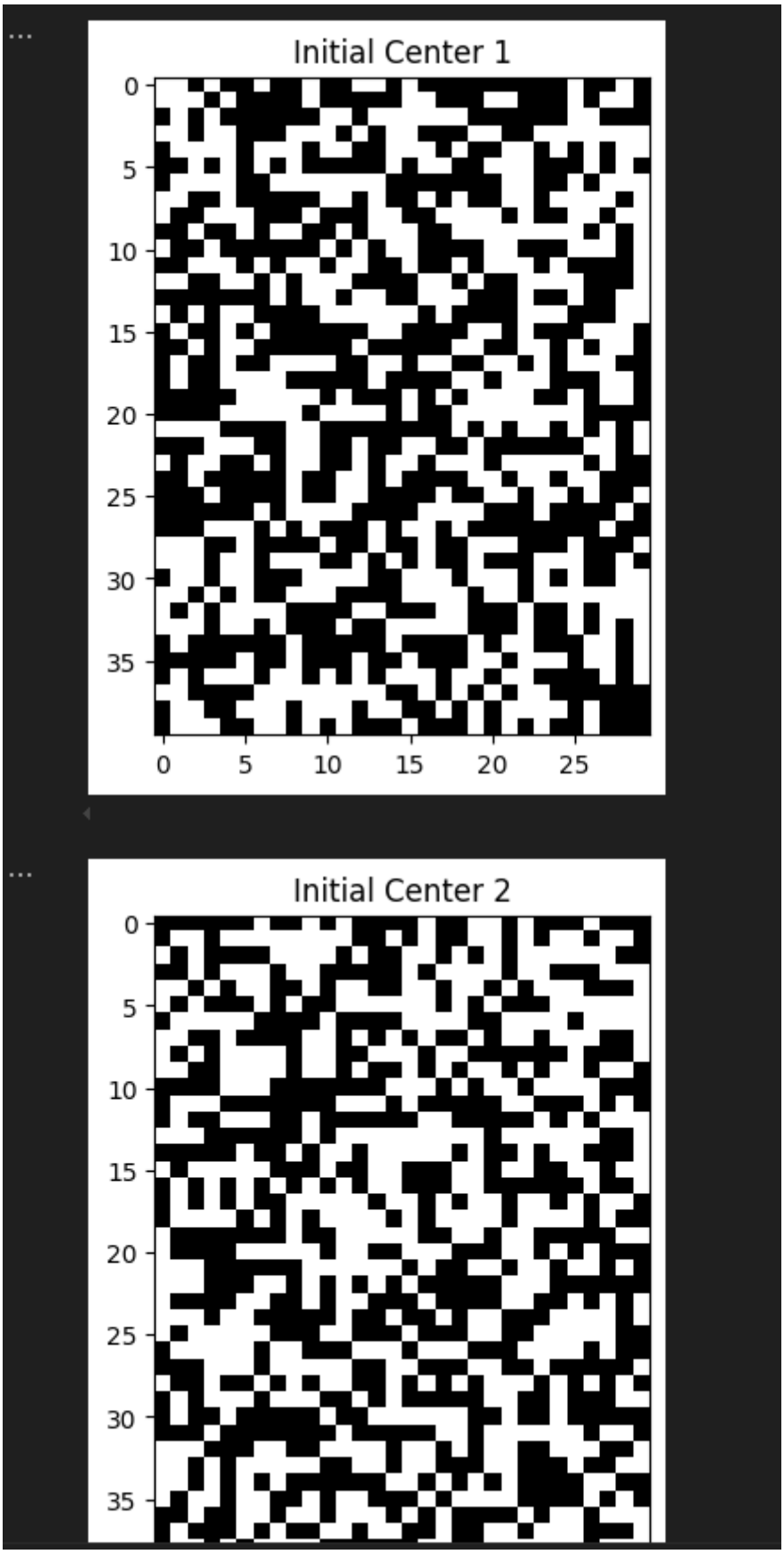
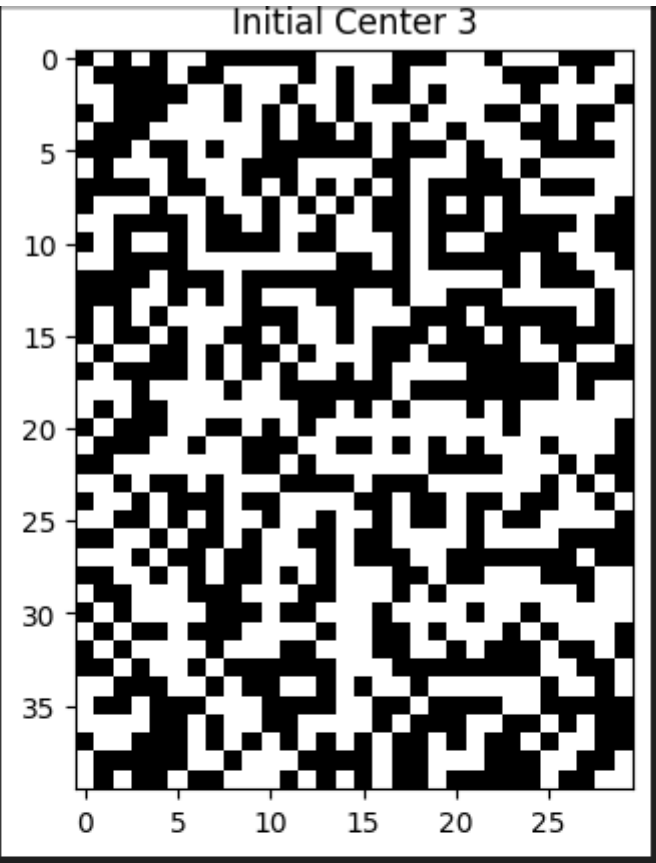
مقدار تابع هزینه



b.I:

شاخص های اولیه تصادفی ساخته شده

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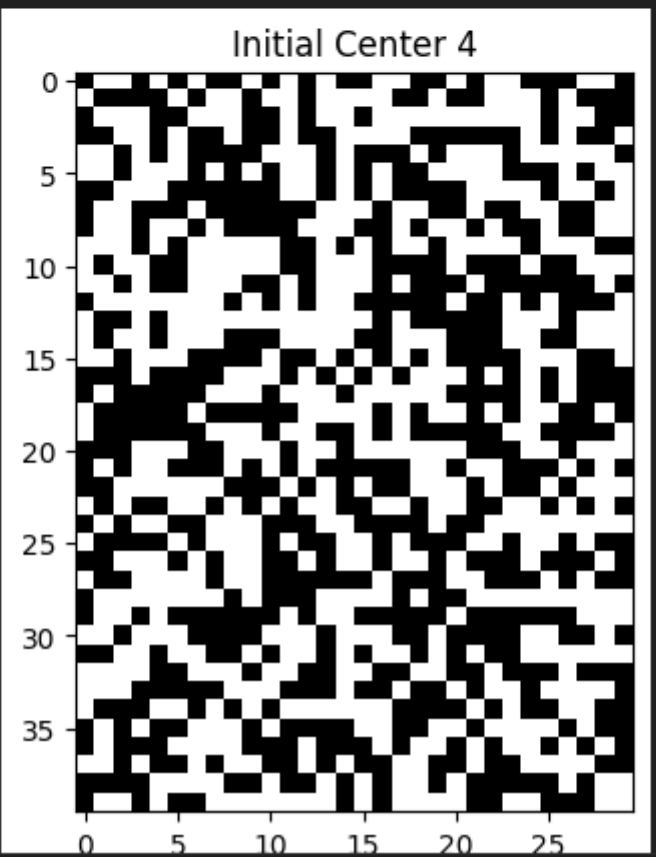
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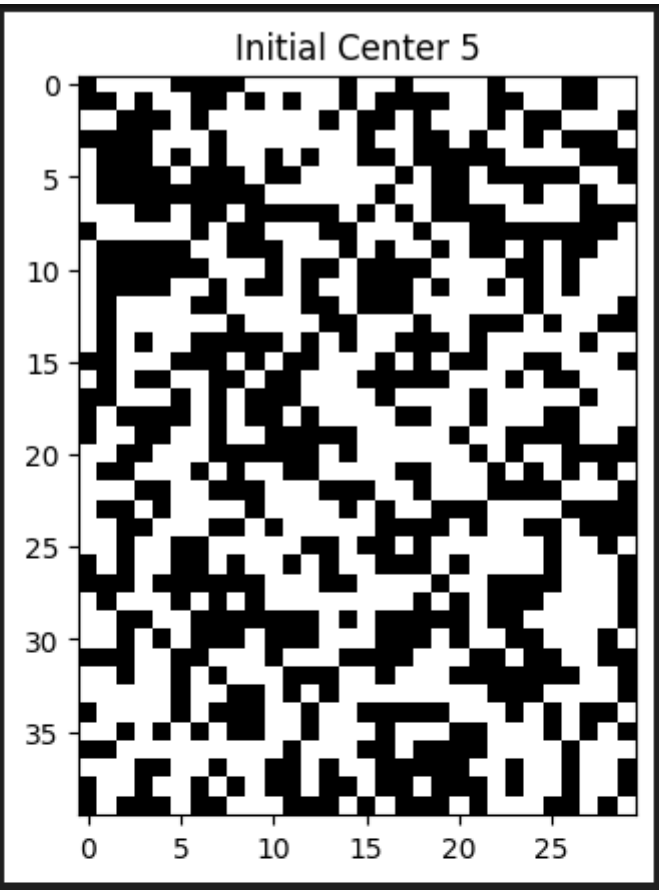
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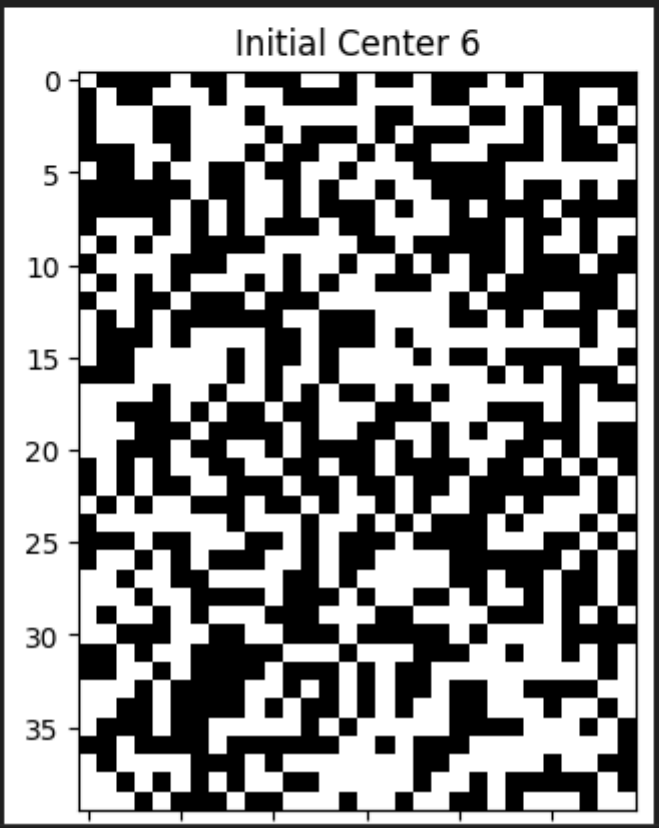
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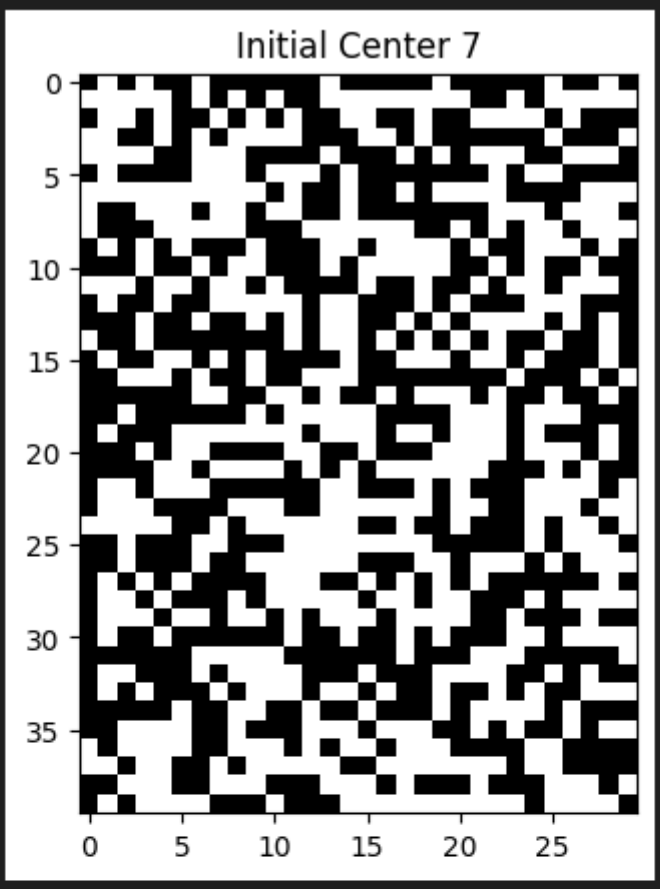
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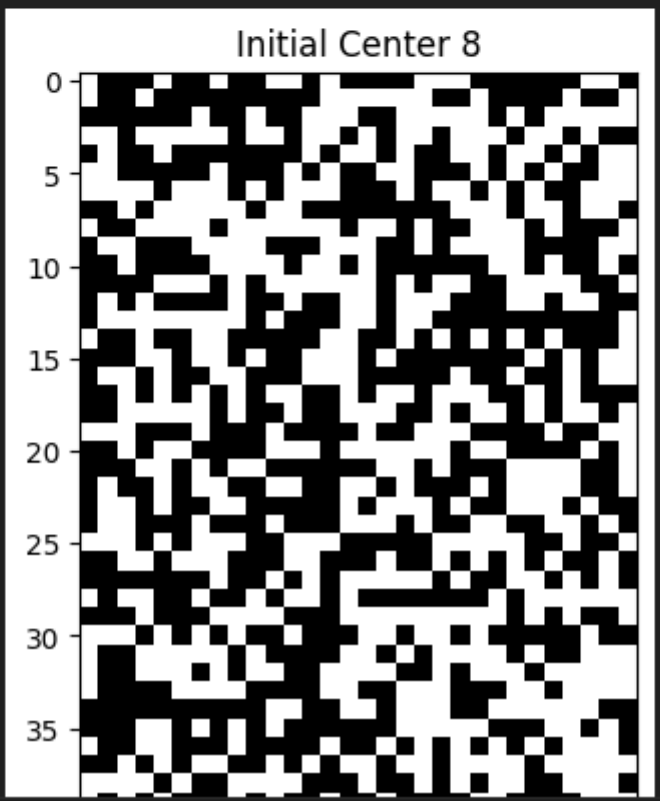
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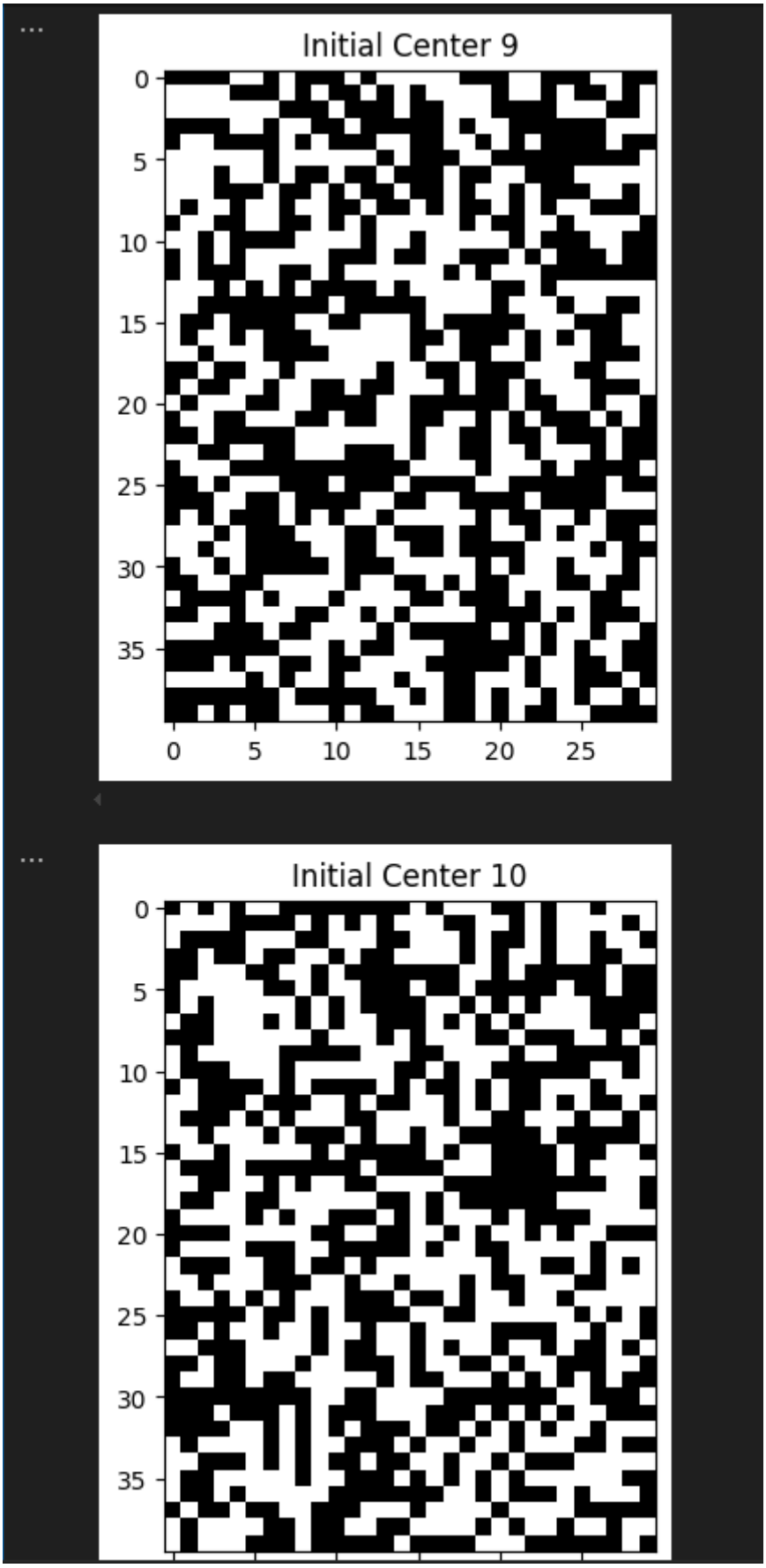
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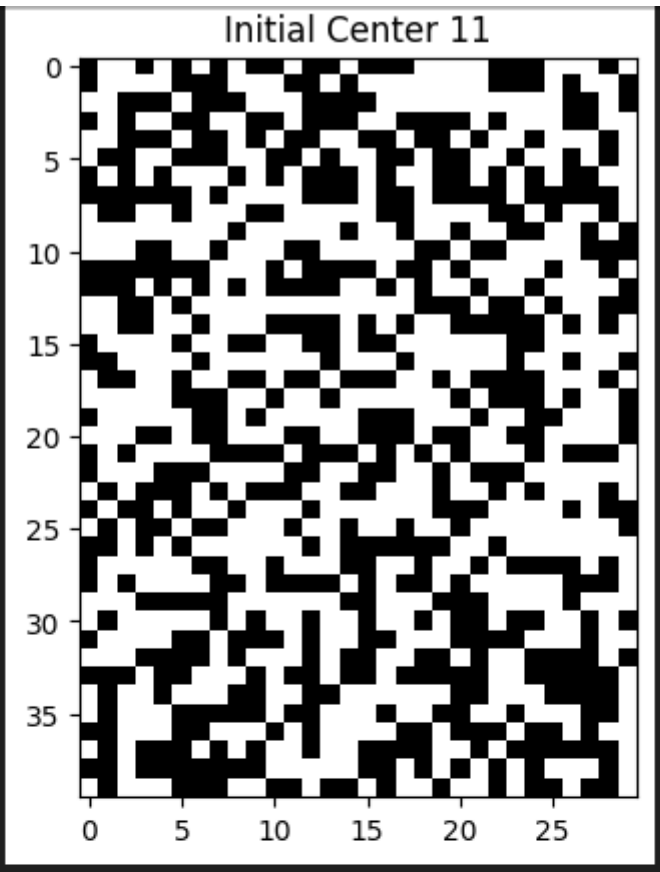
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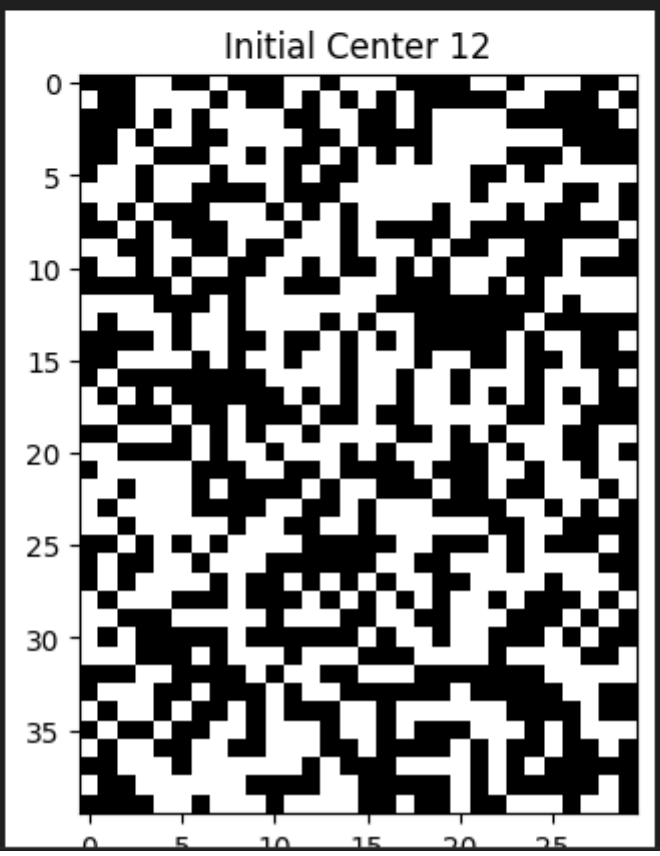
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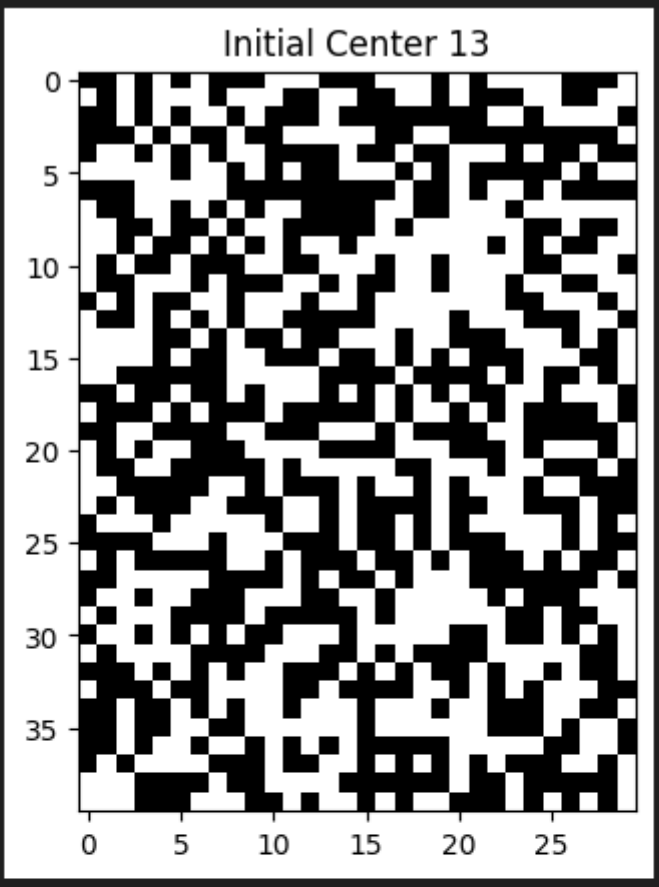
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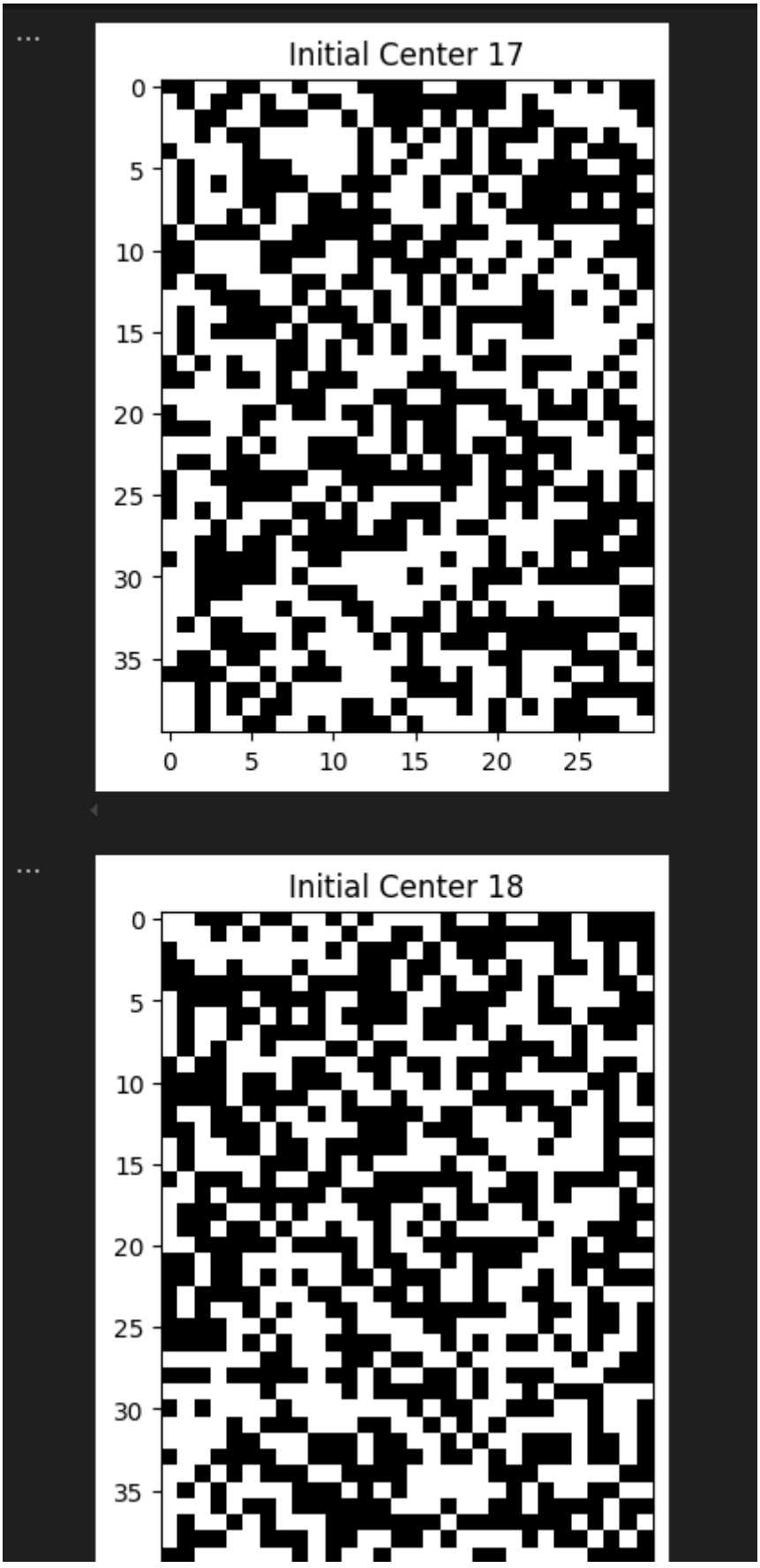
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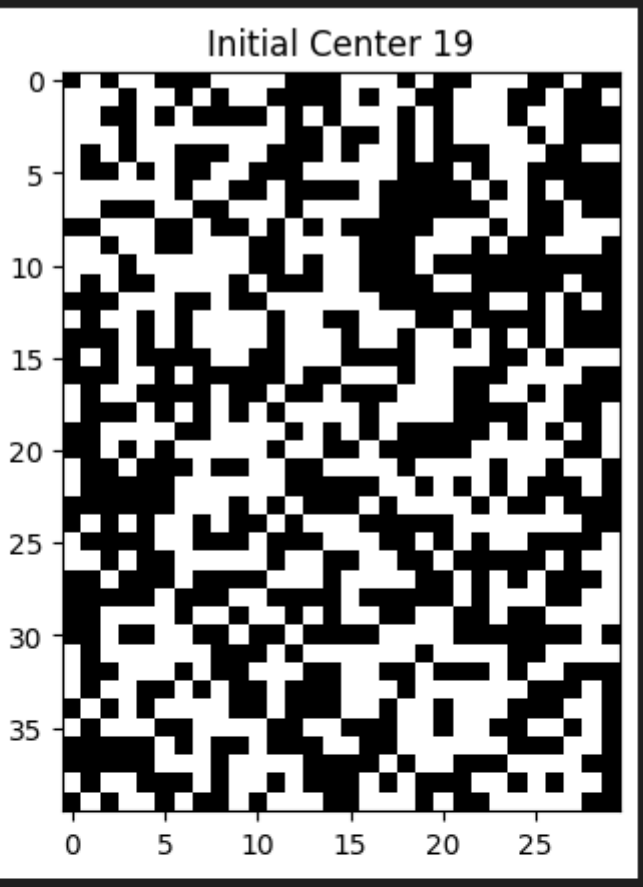
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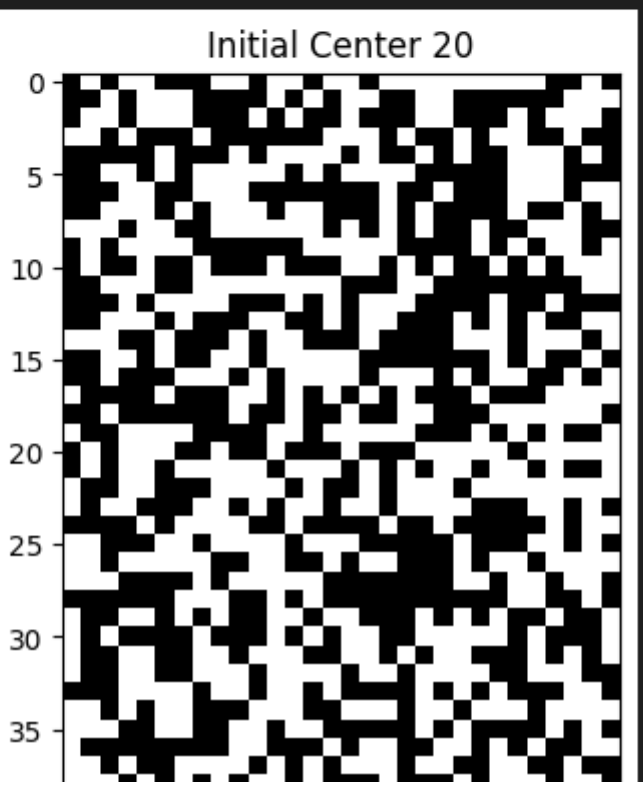
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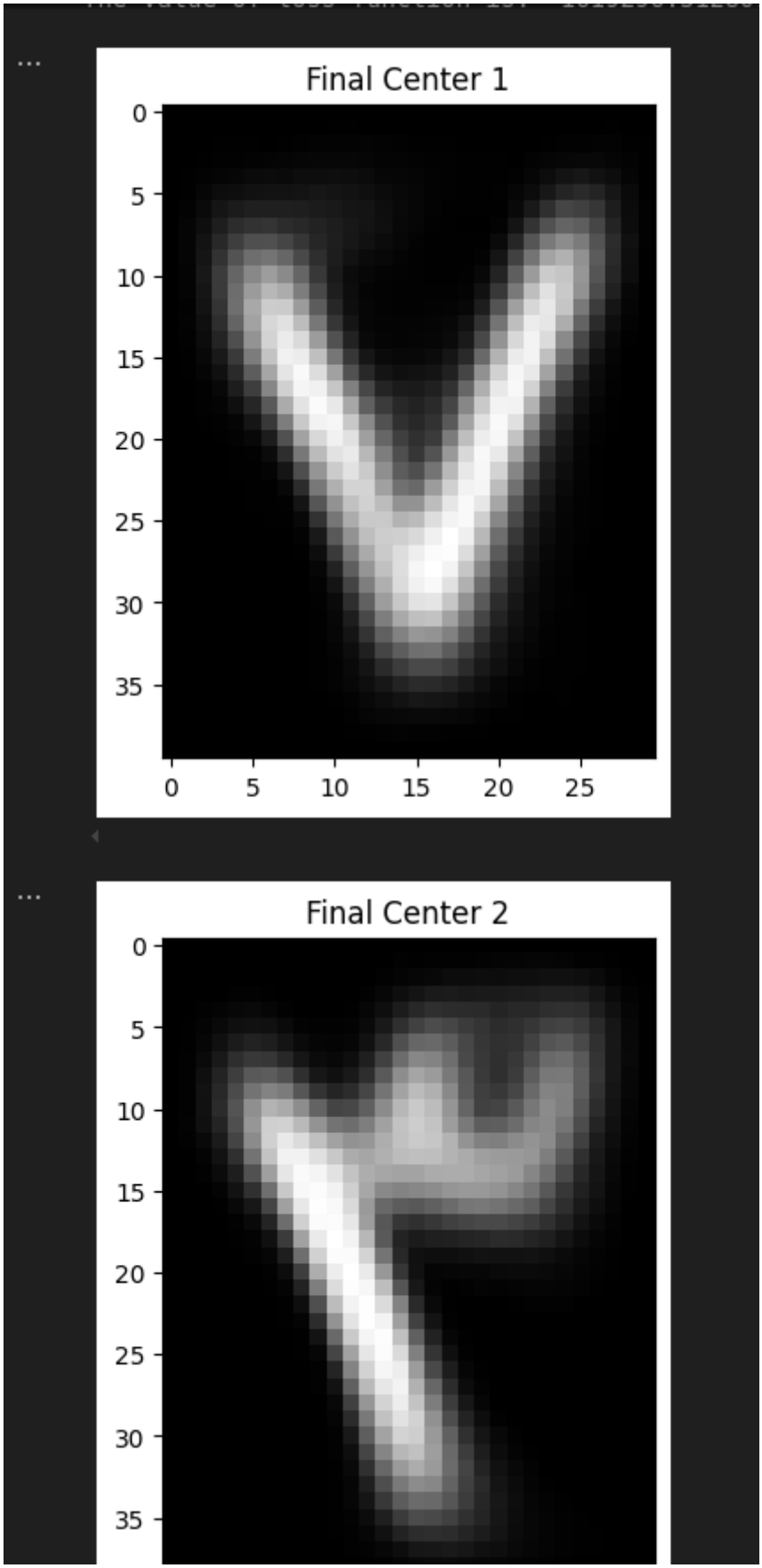
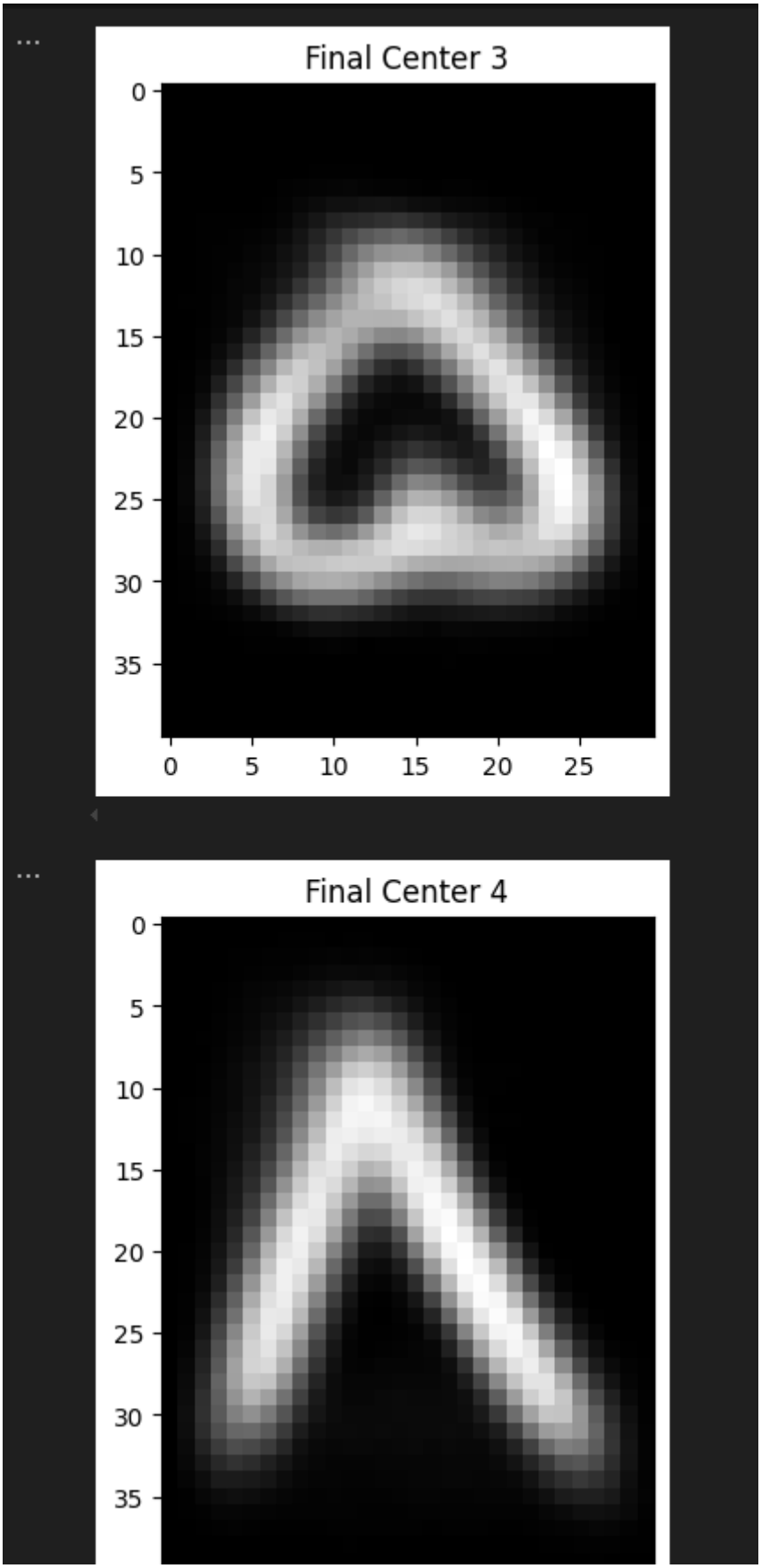
شاخص های نهایی

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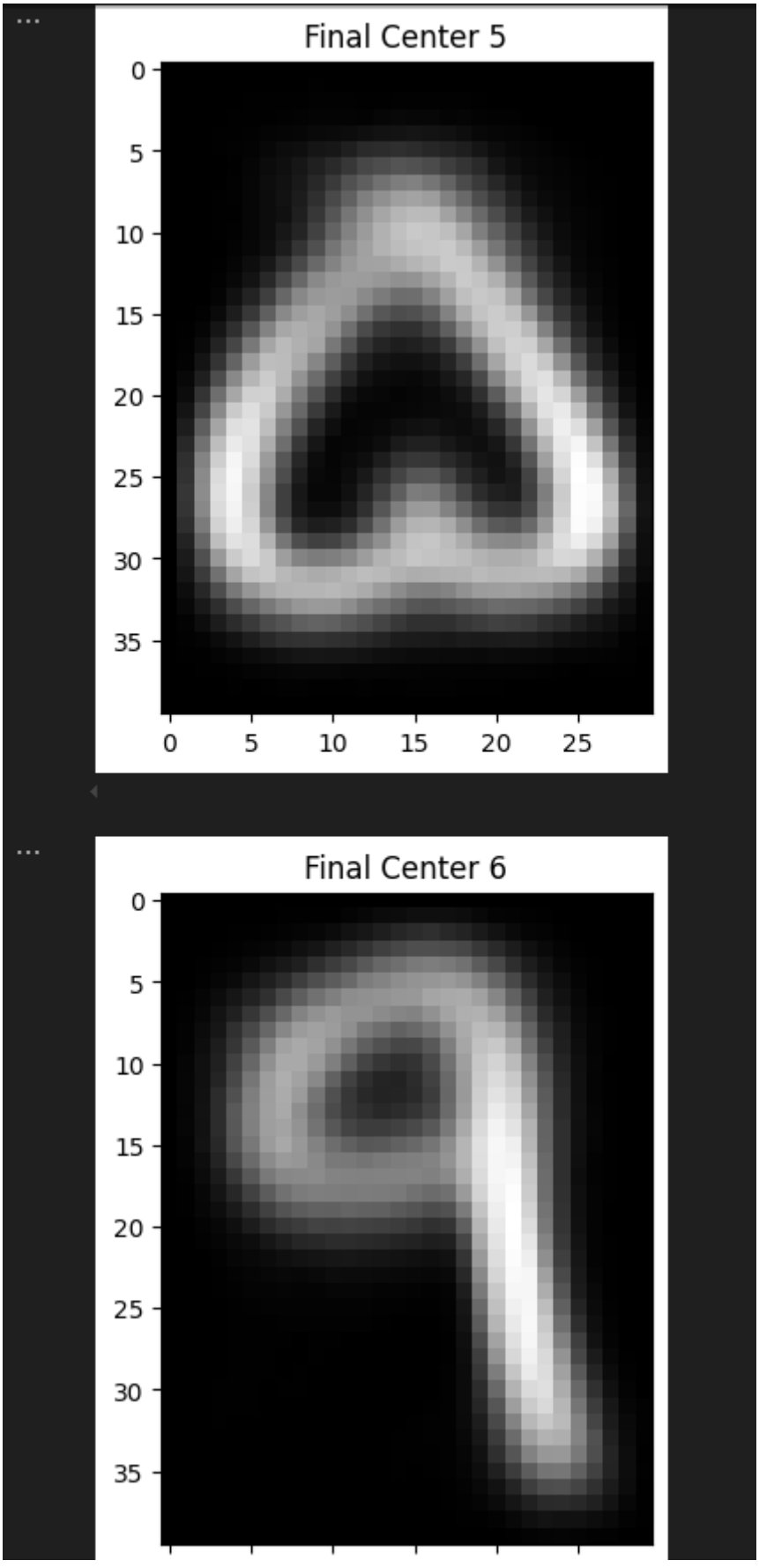
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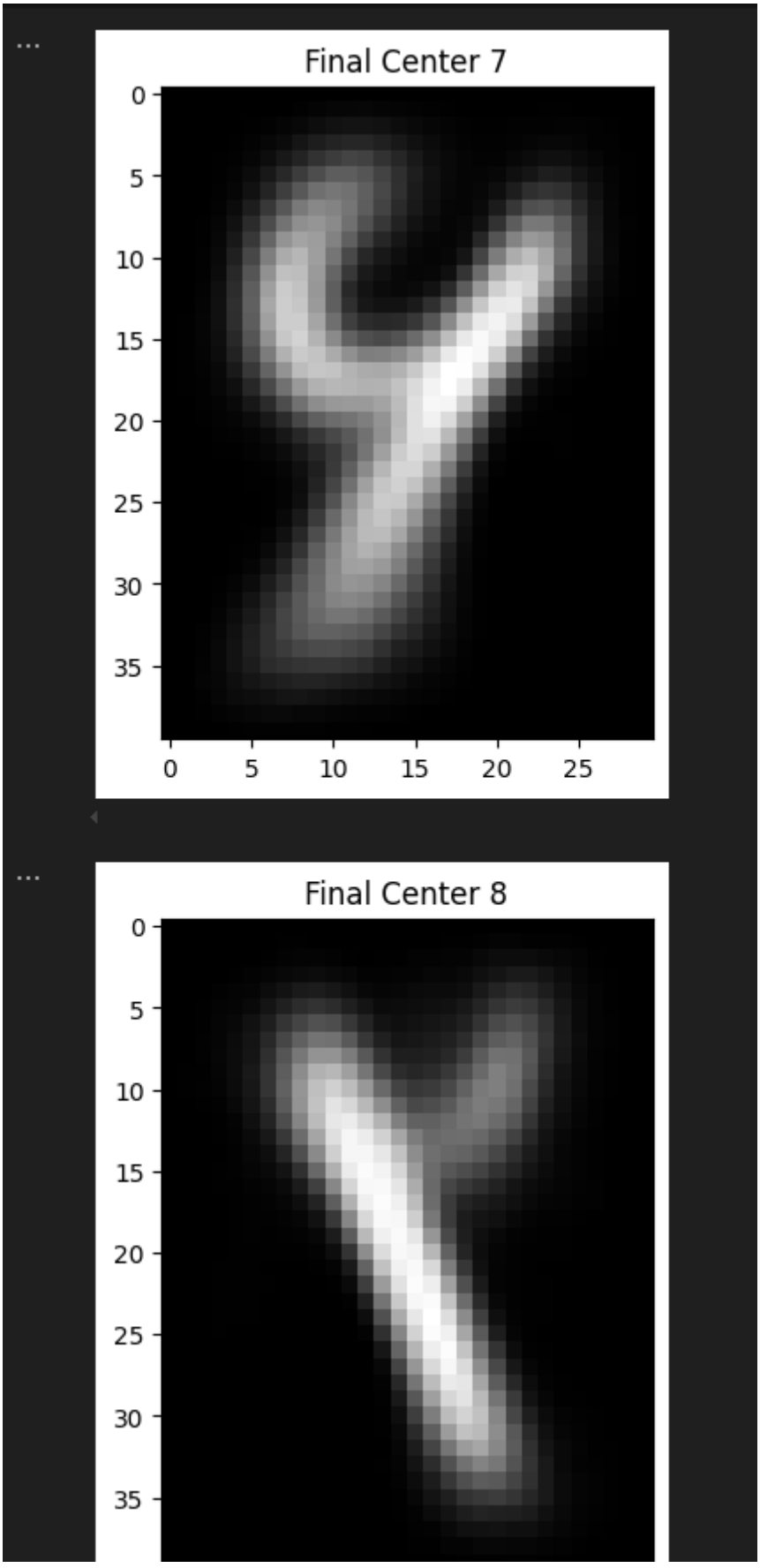
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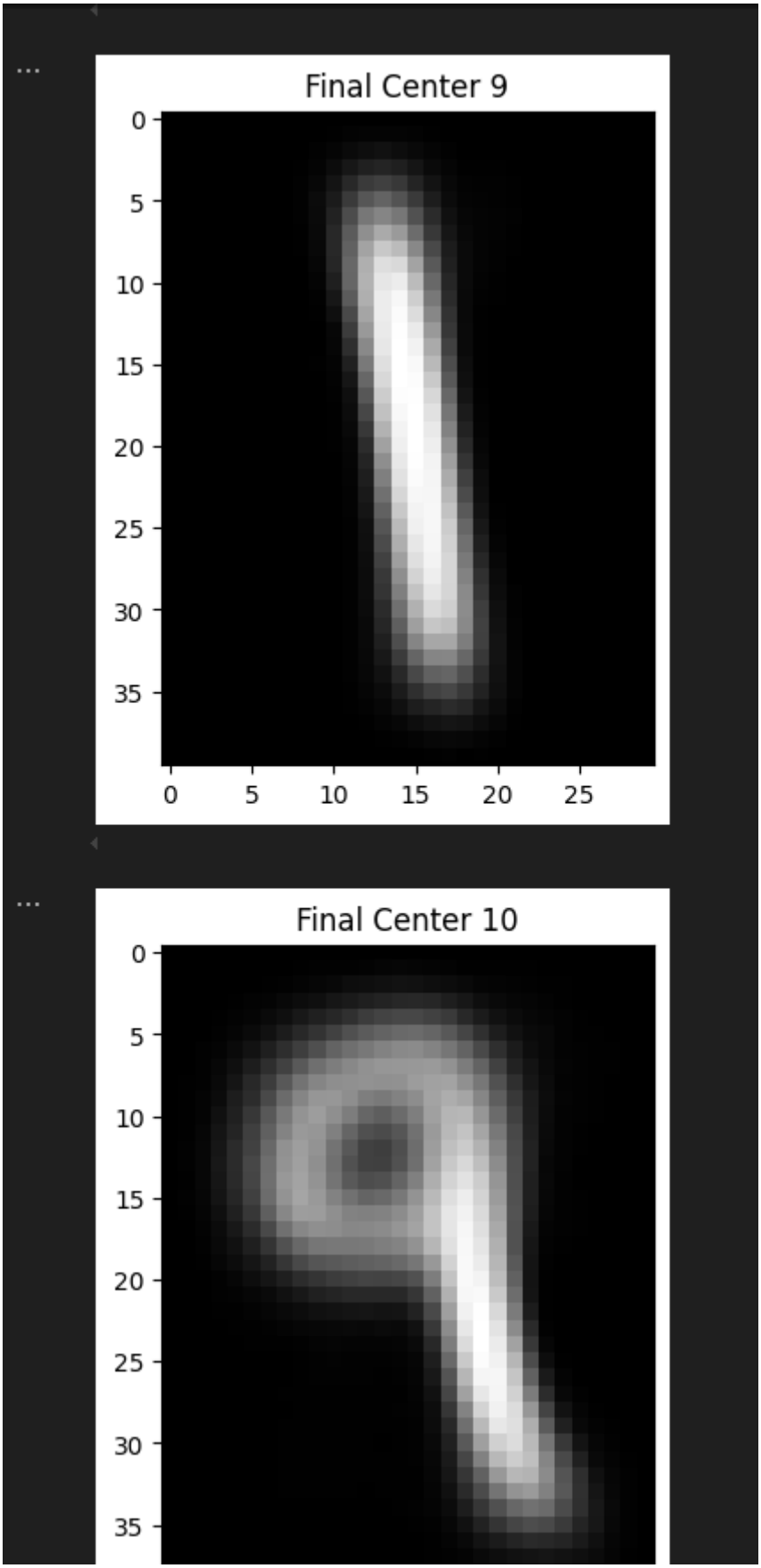
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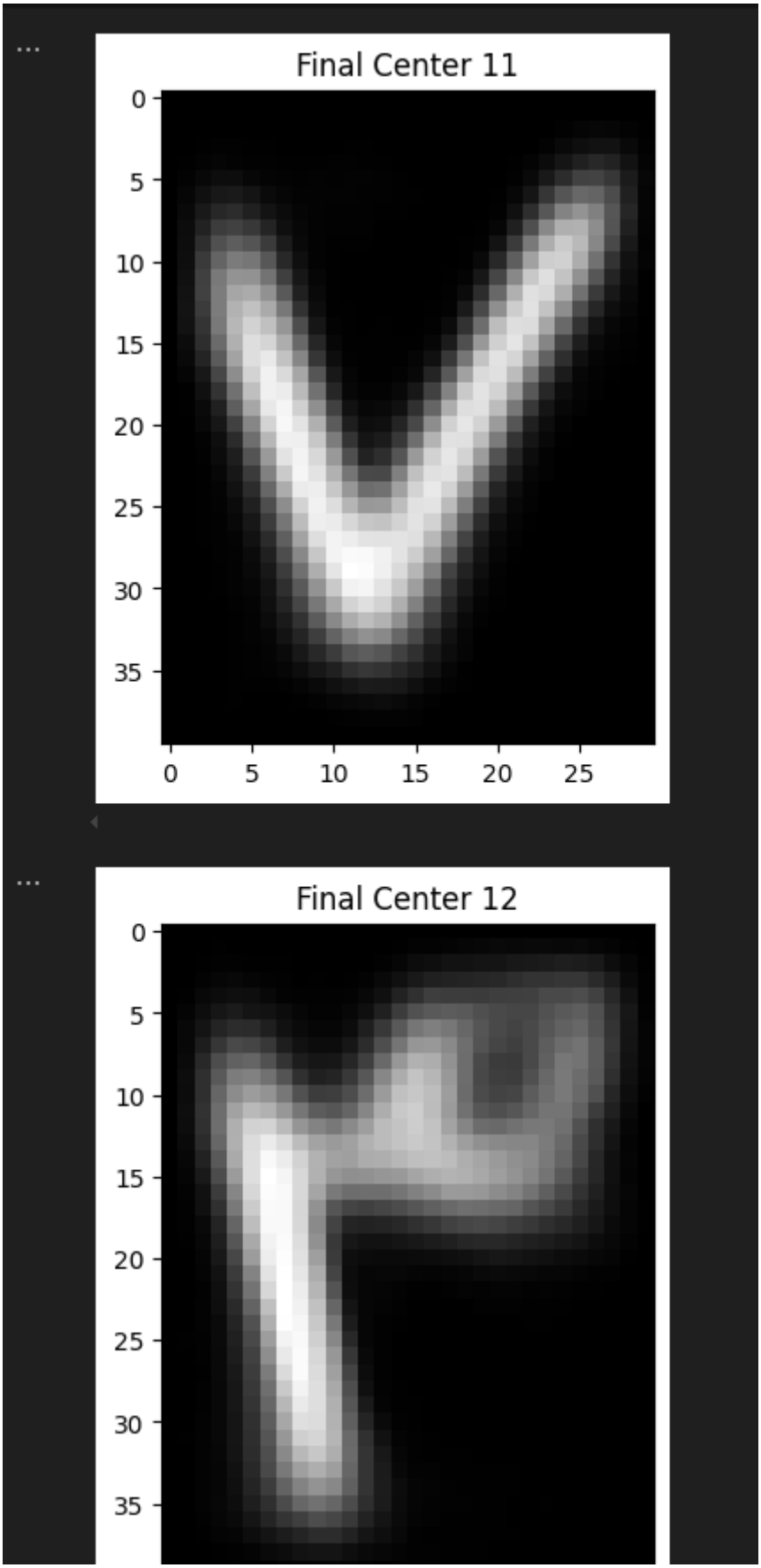
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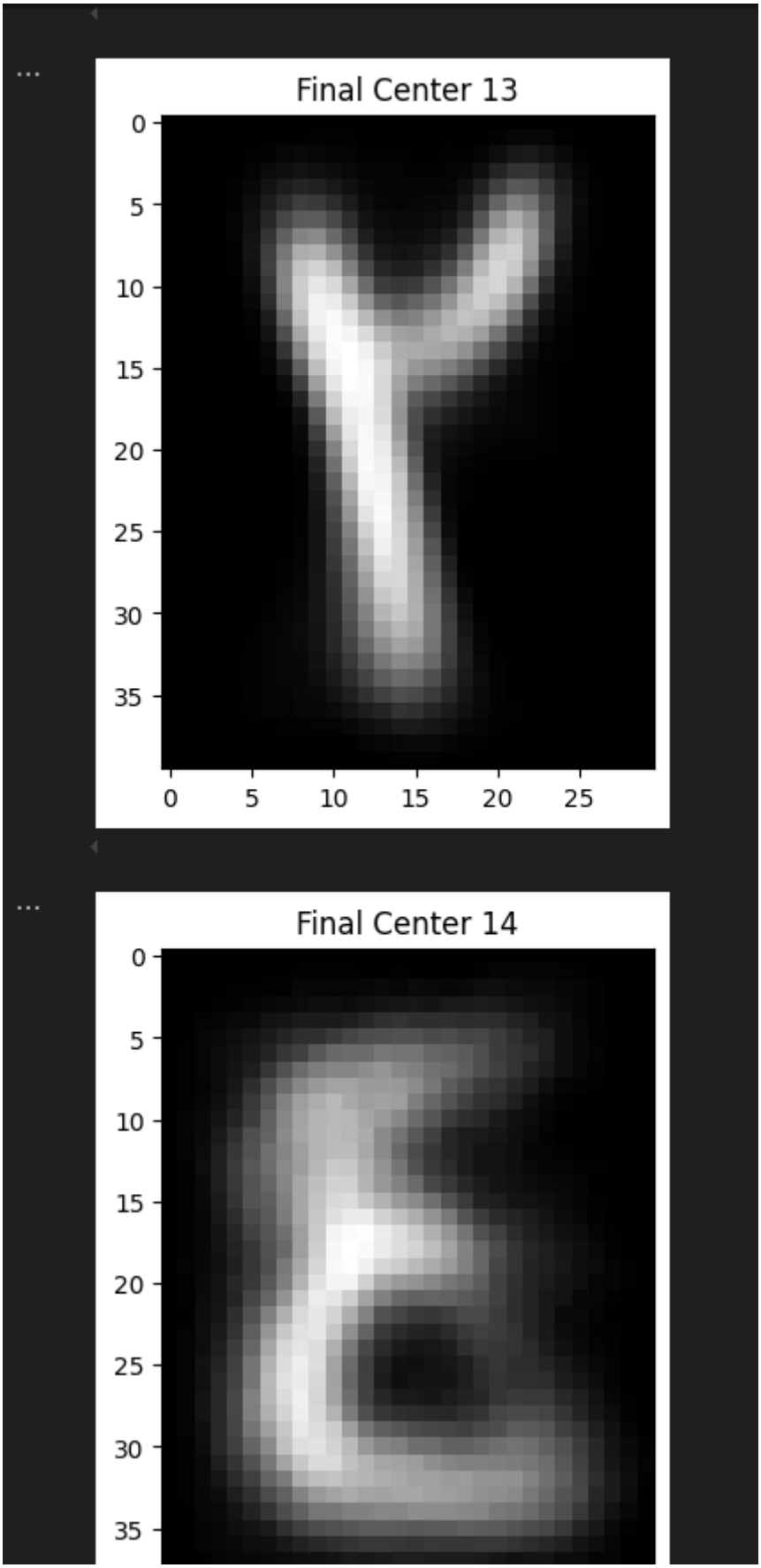
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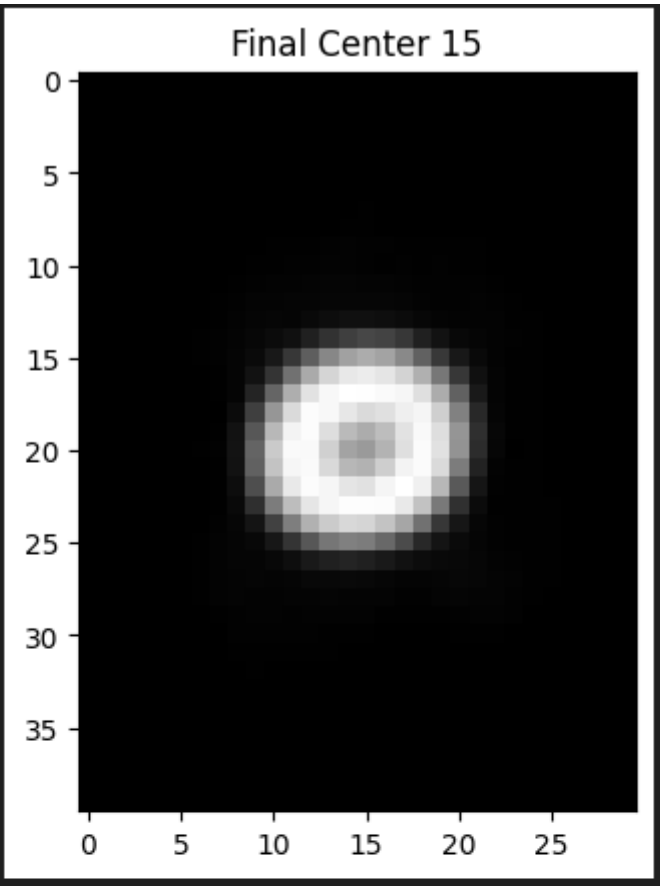
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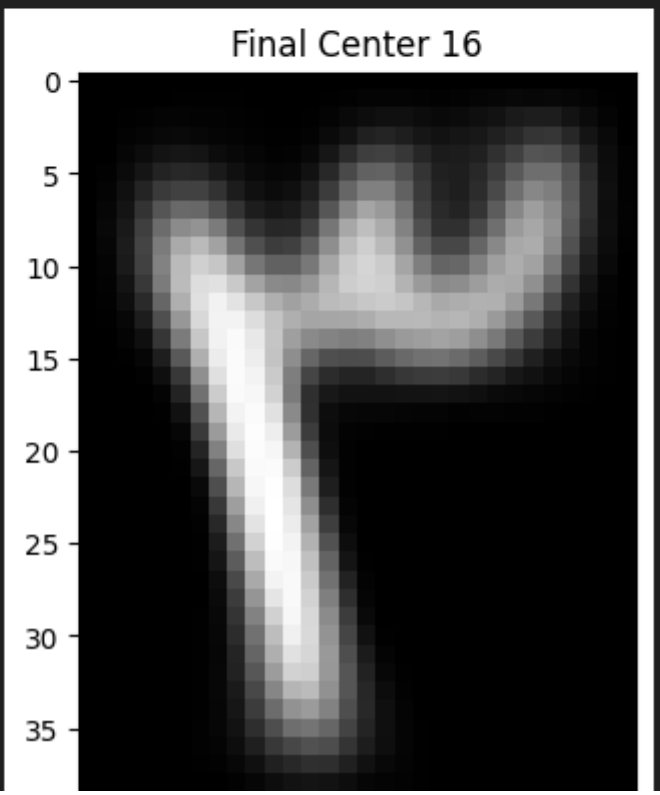
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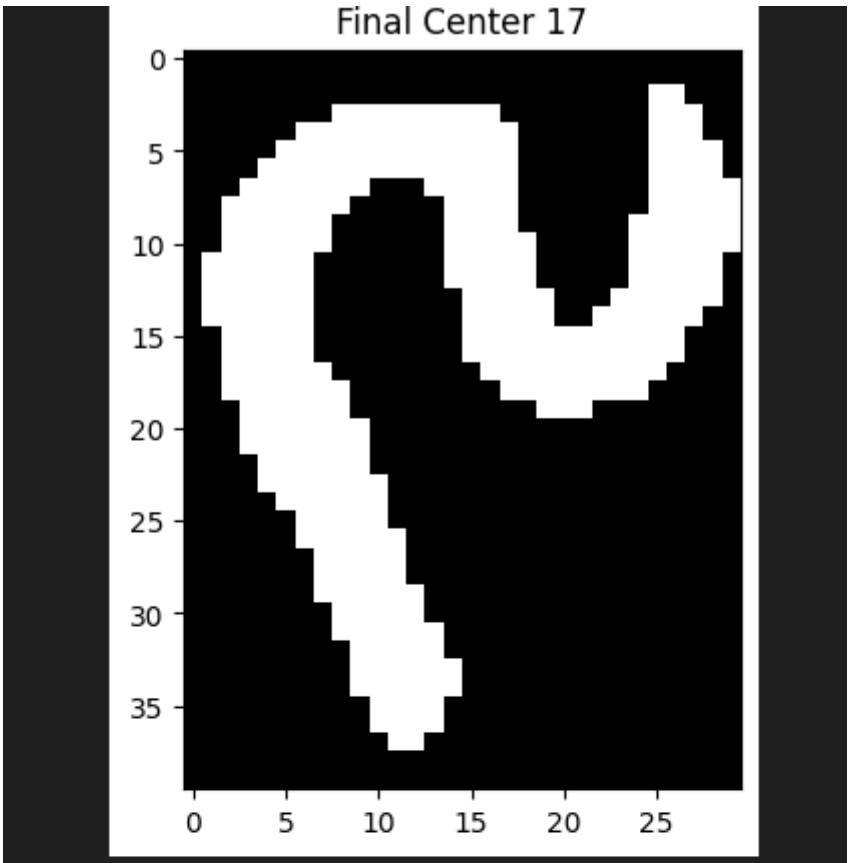
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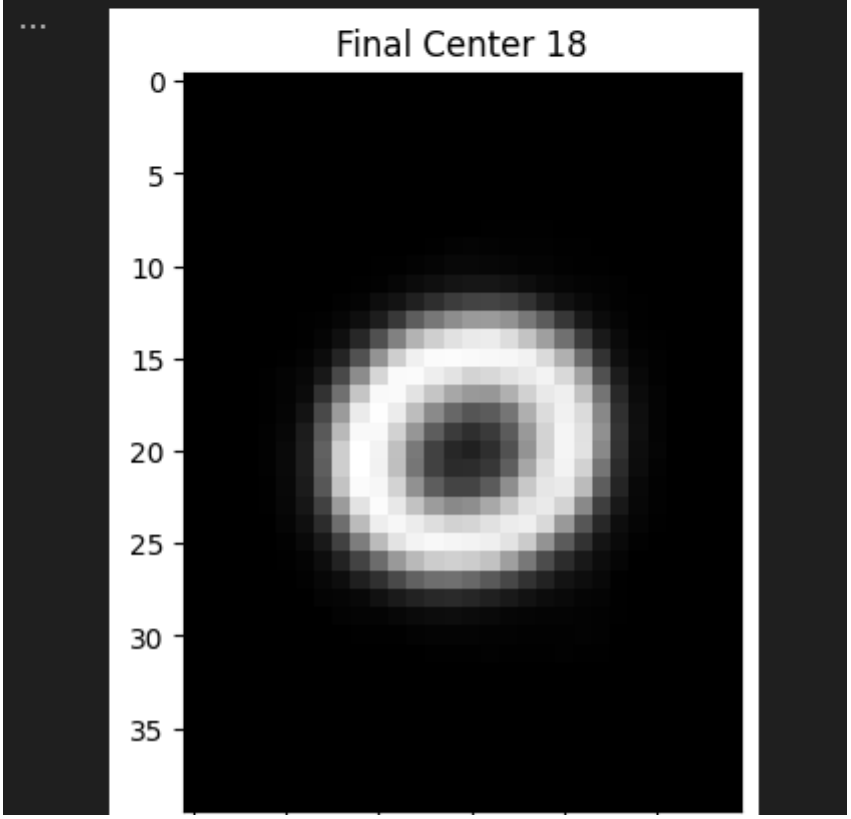
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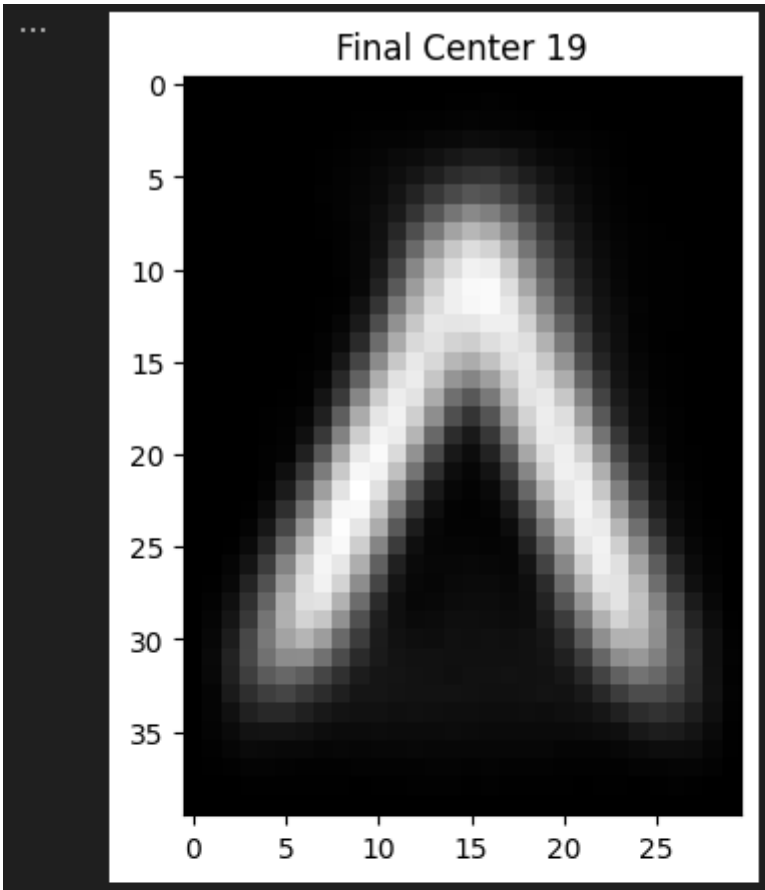
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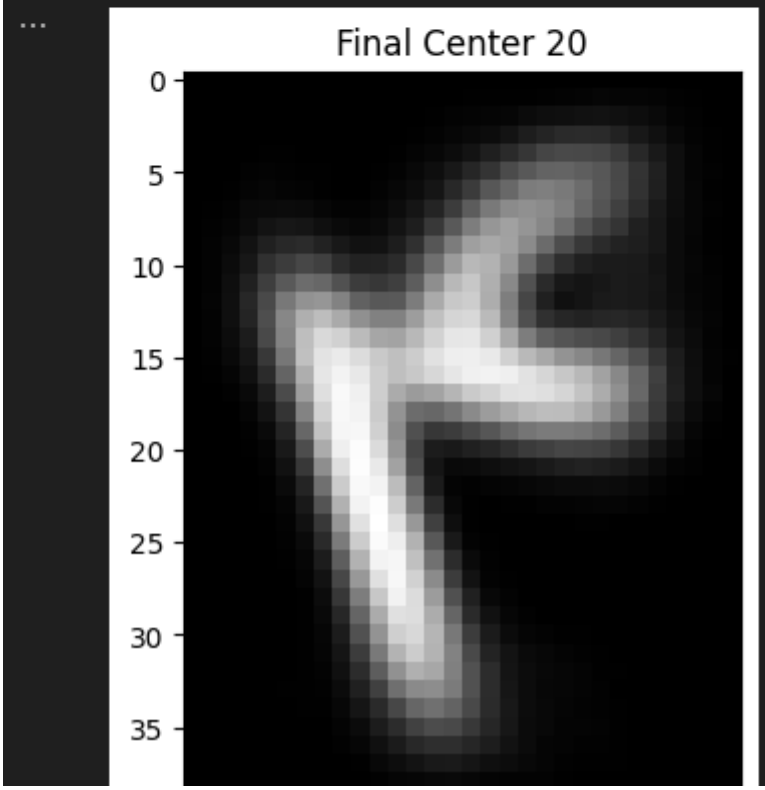
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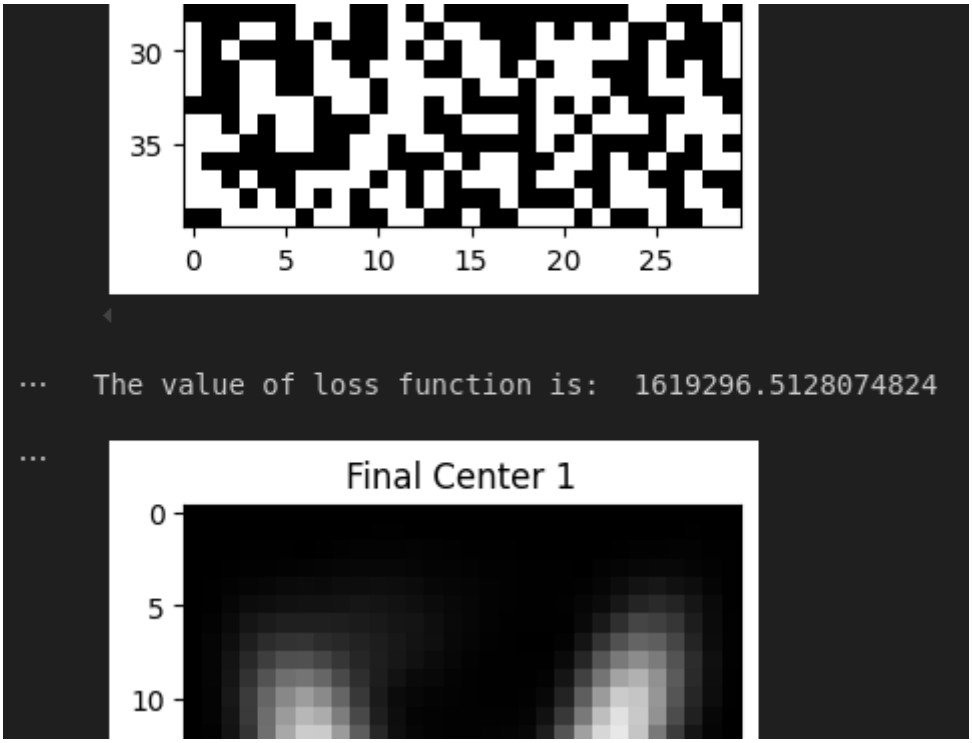
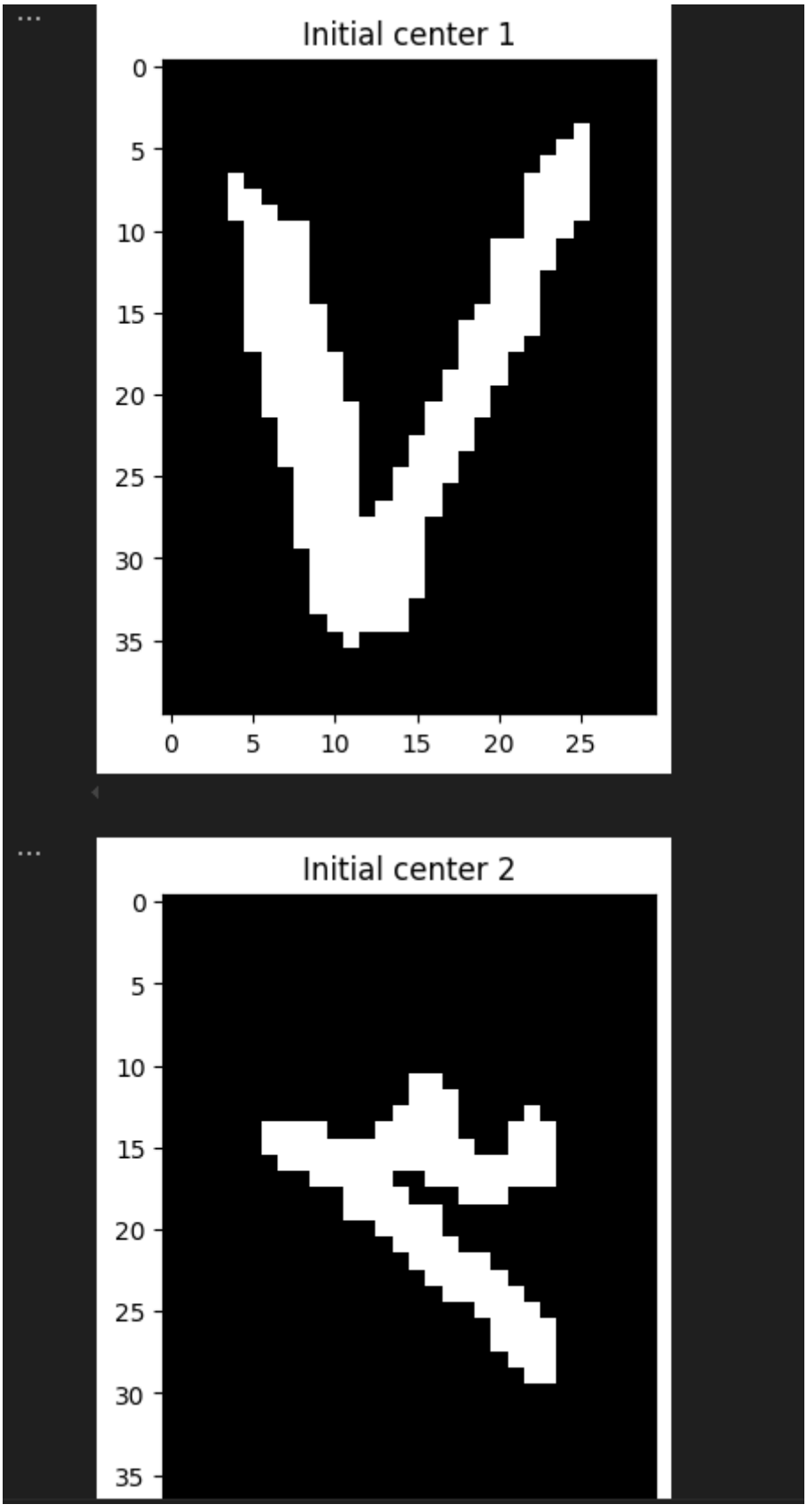
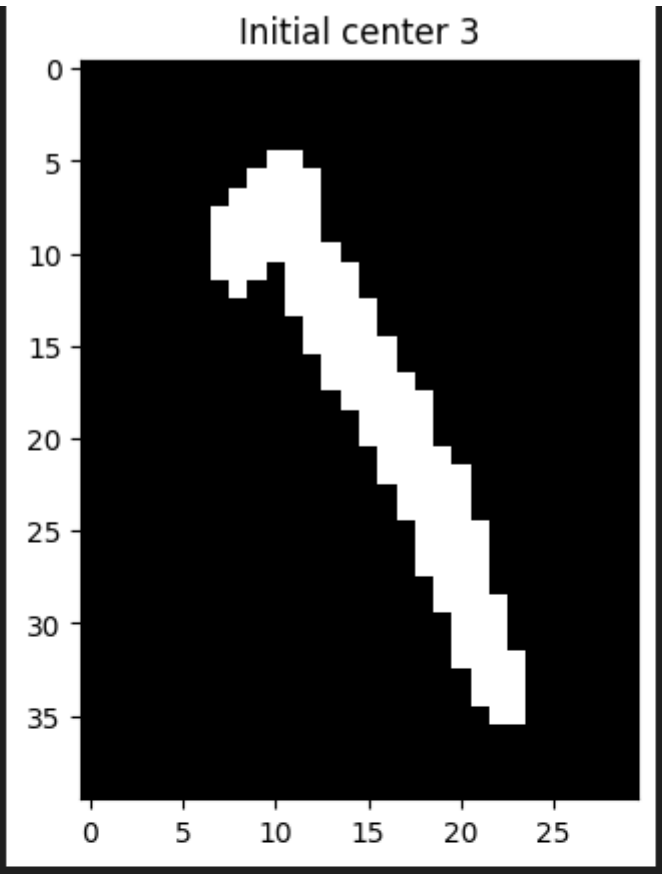
مقدار تابع هزینه



b.II:

شاخص های اولیه تصادفی انتخاب شده از بین داده ها

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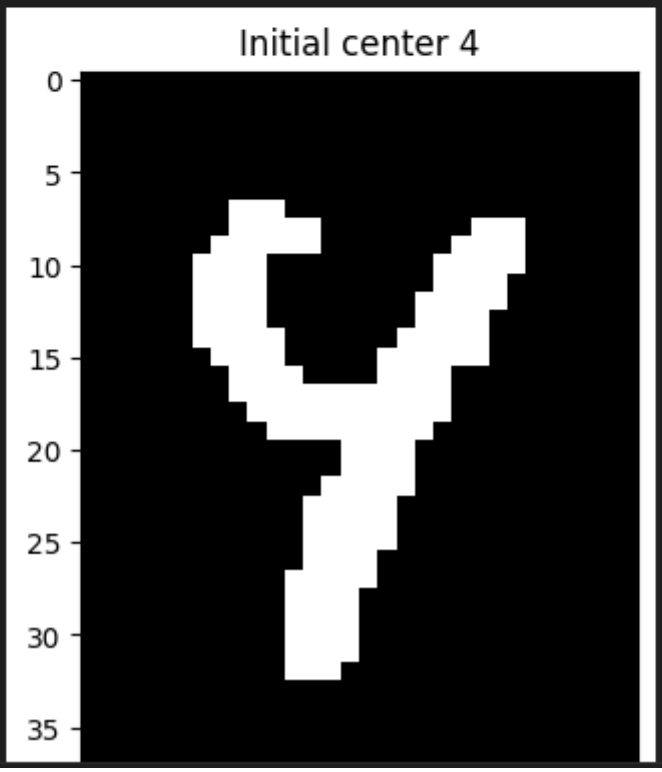
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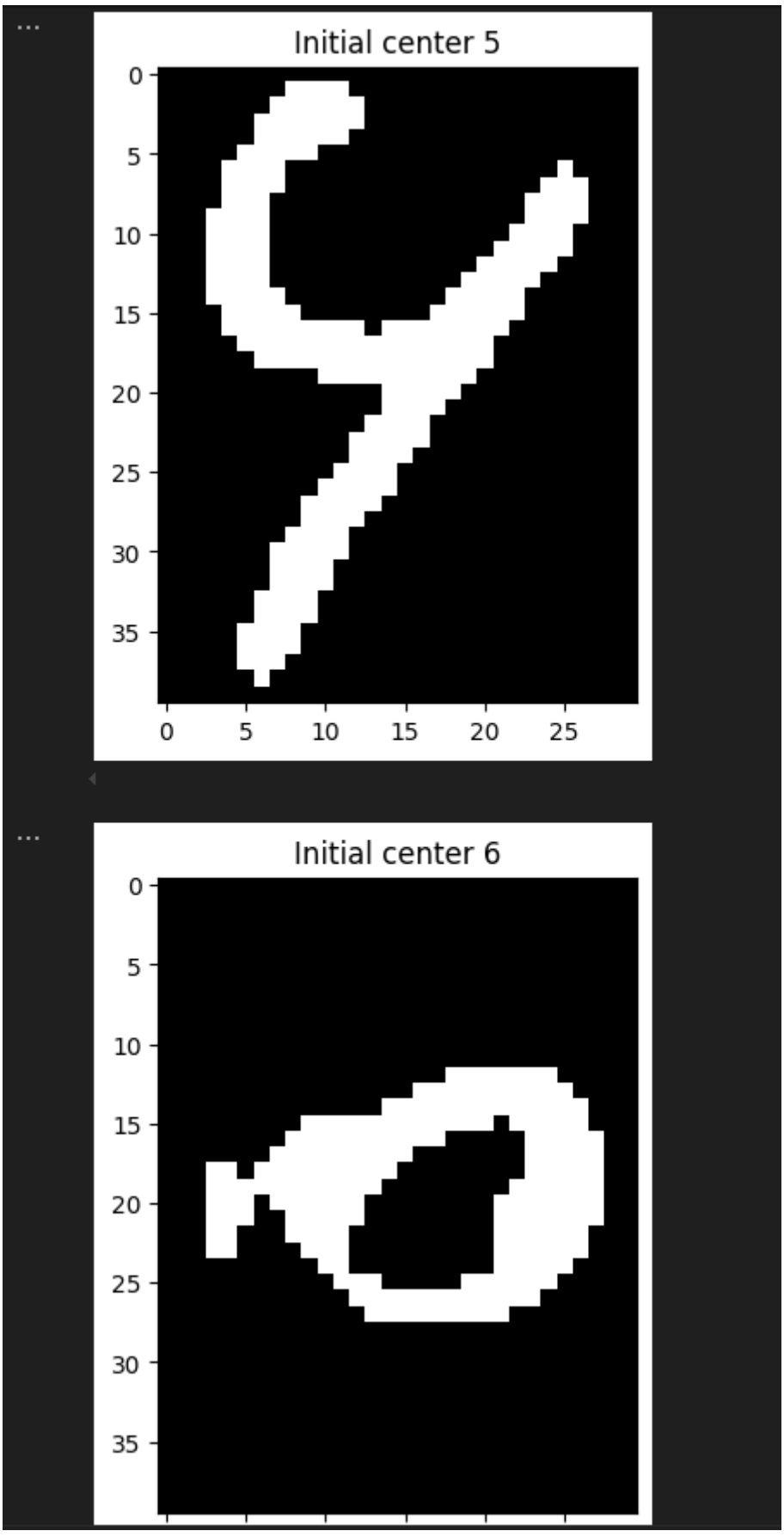
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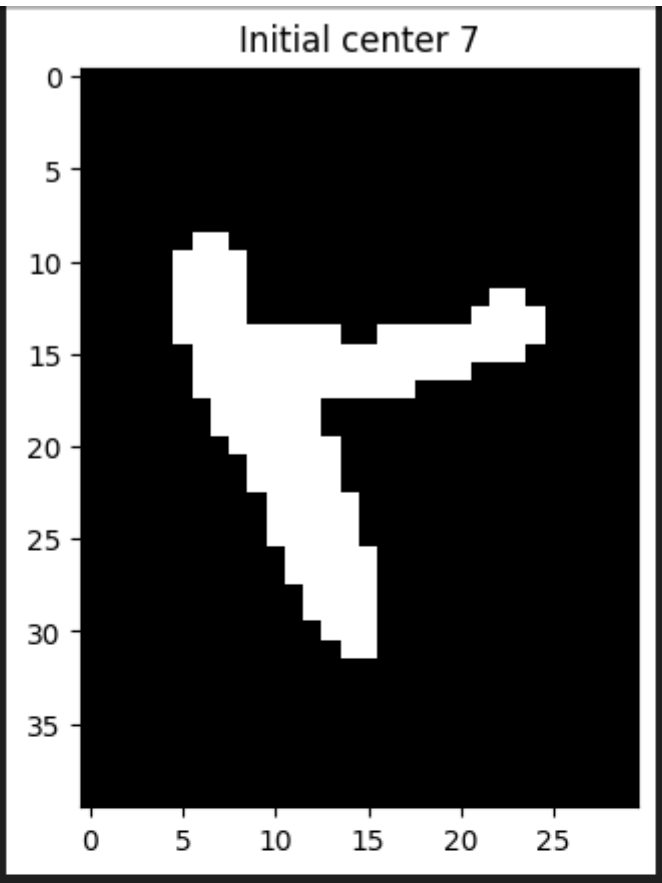
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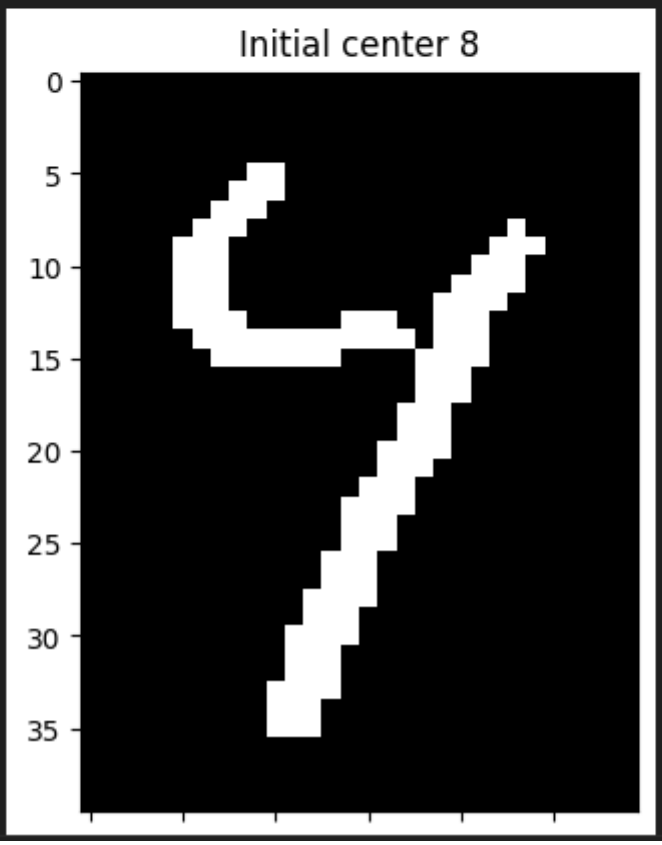
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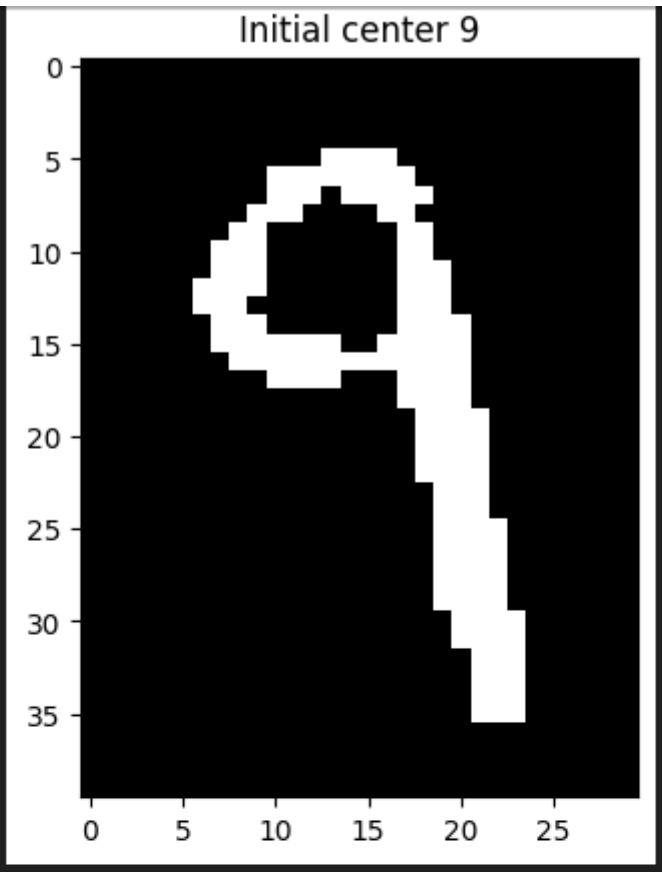
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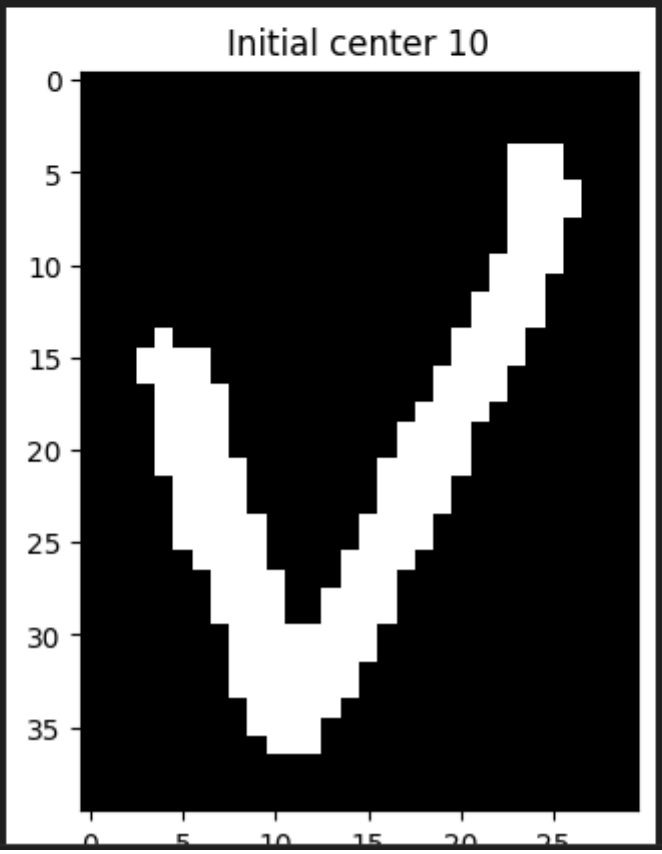
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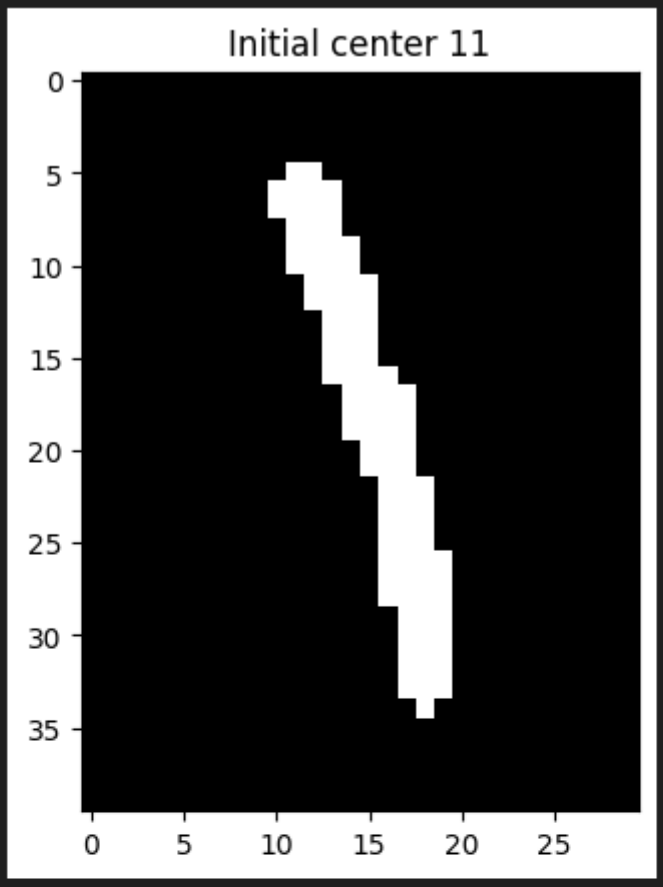
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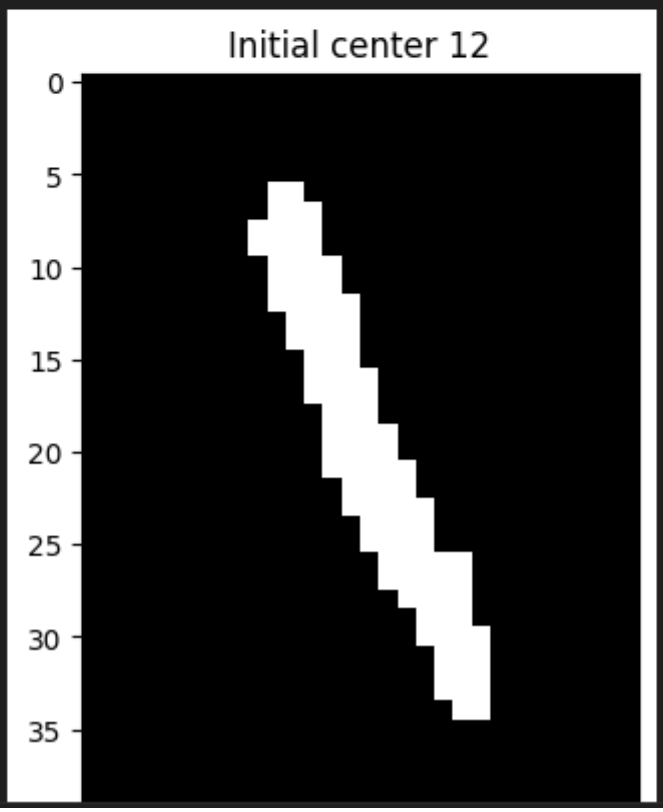
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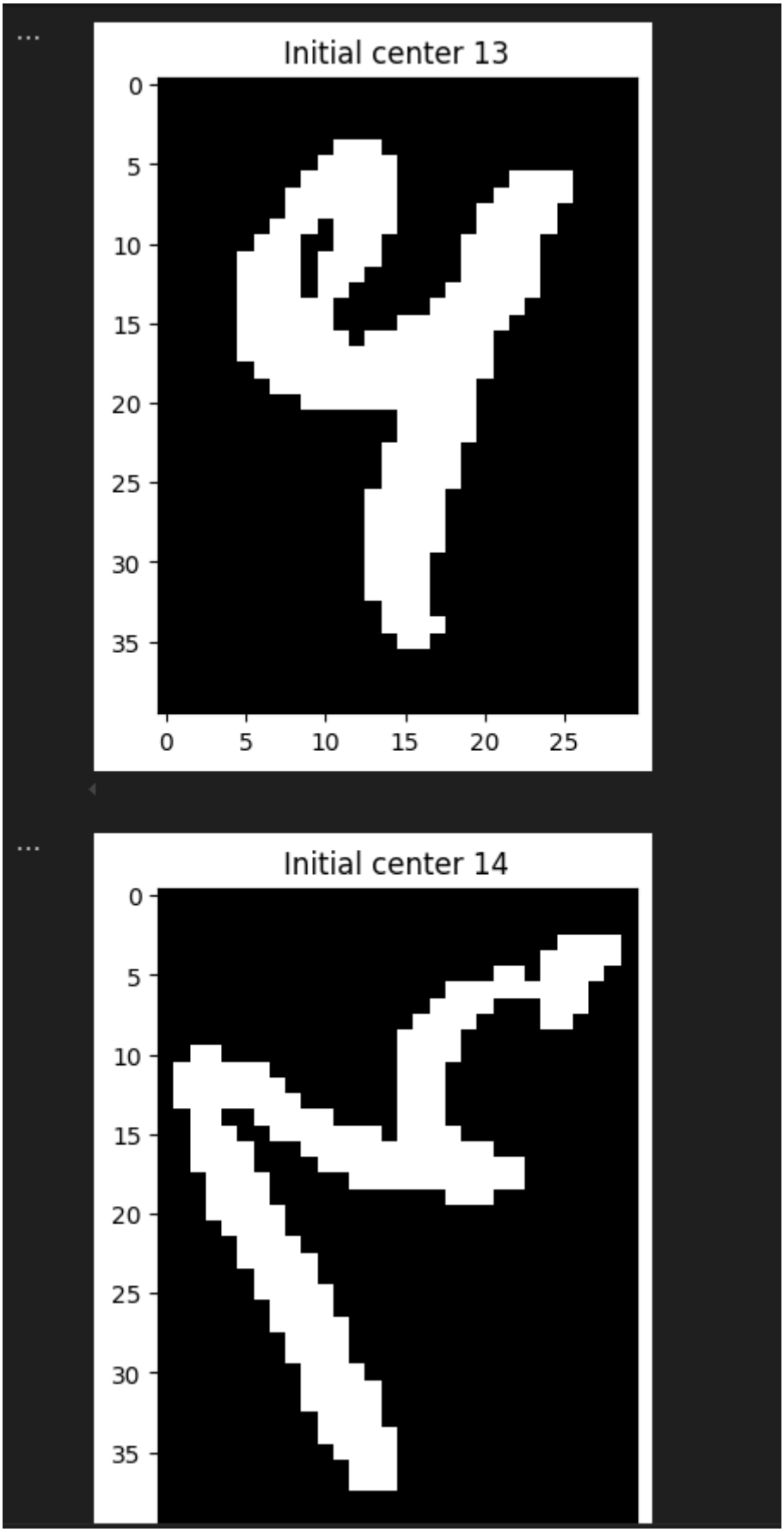
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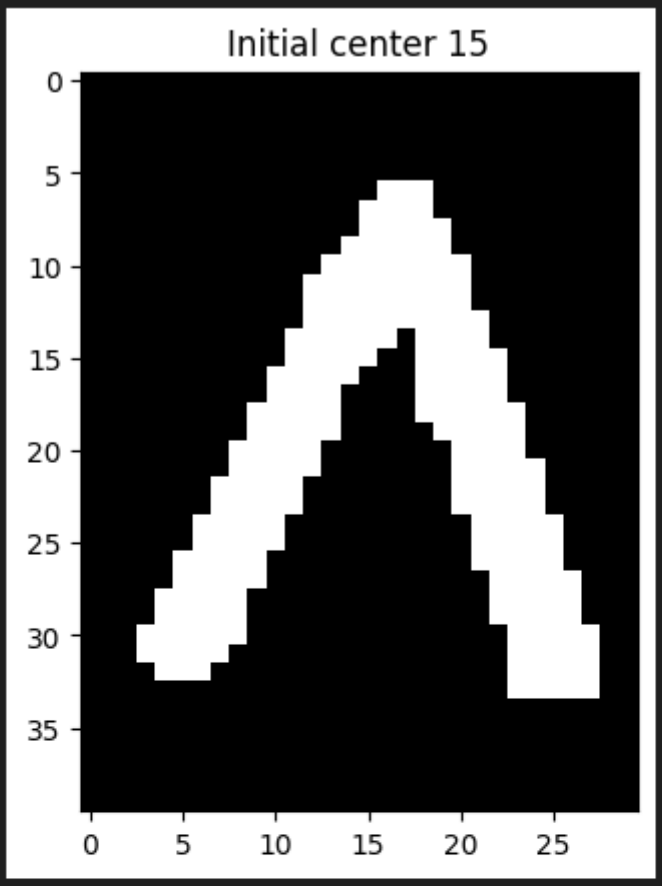
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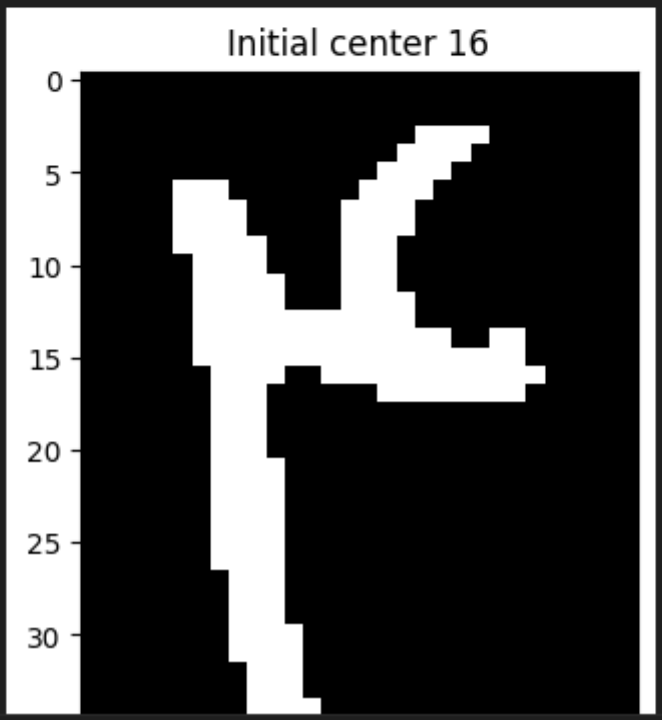
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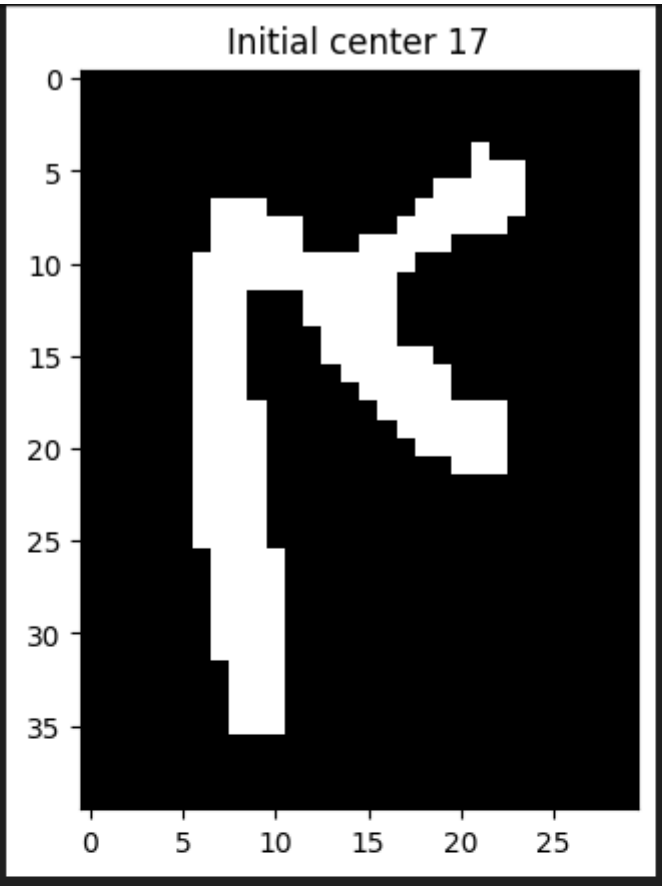
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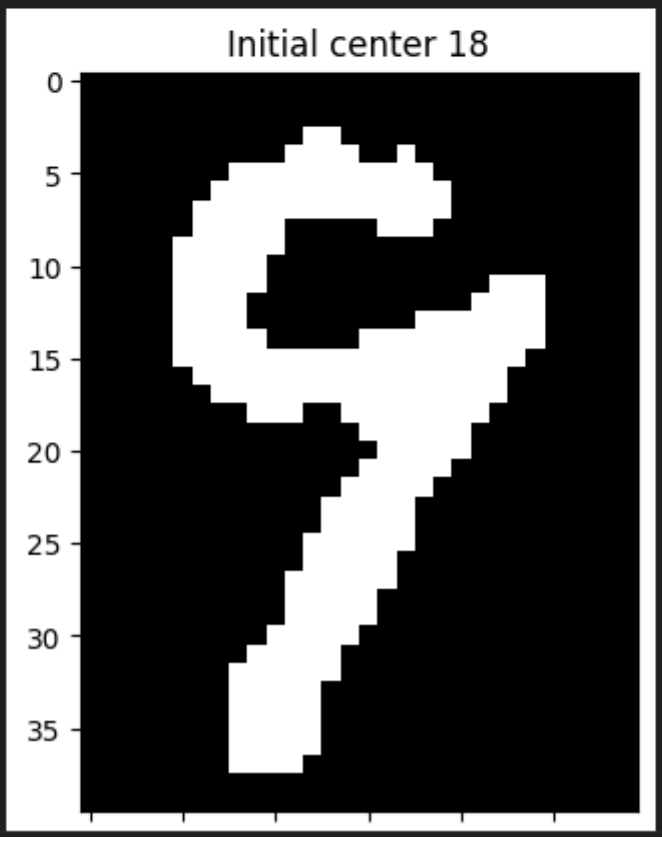
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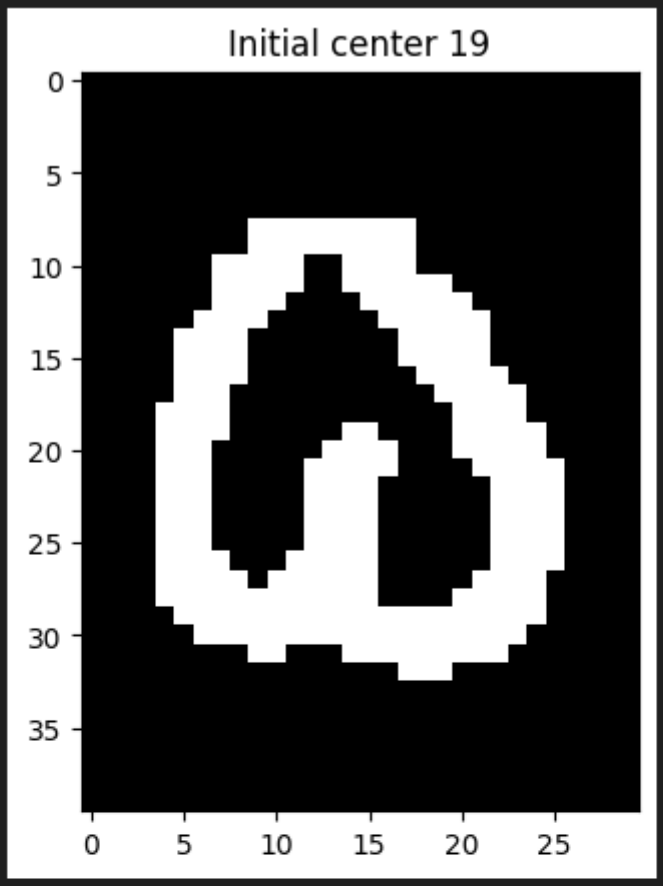
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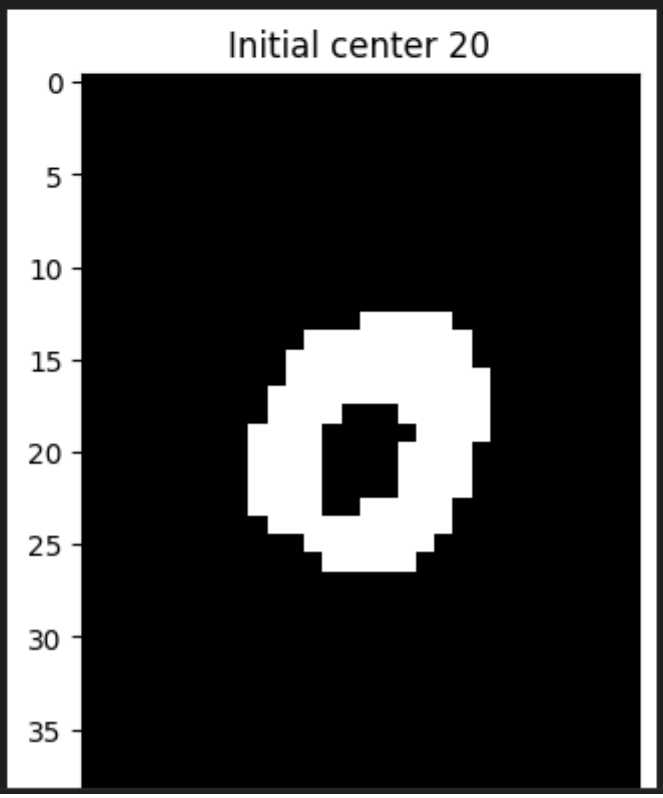
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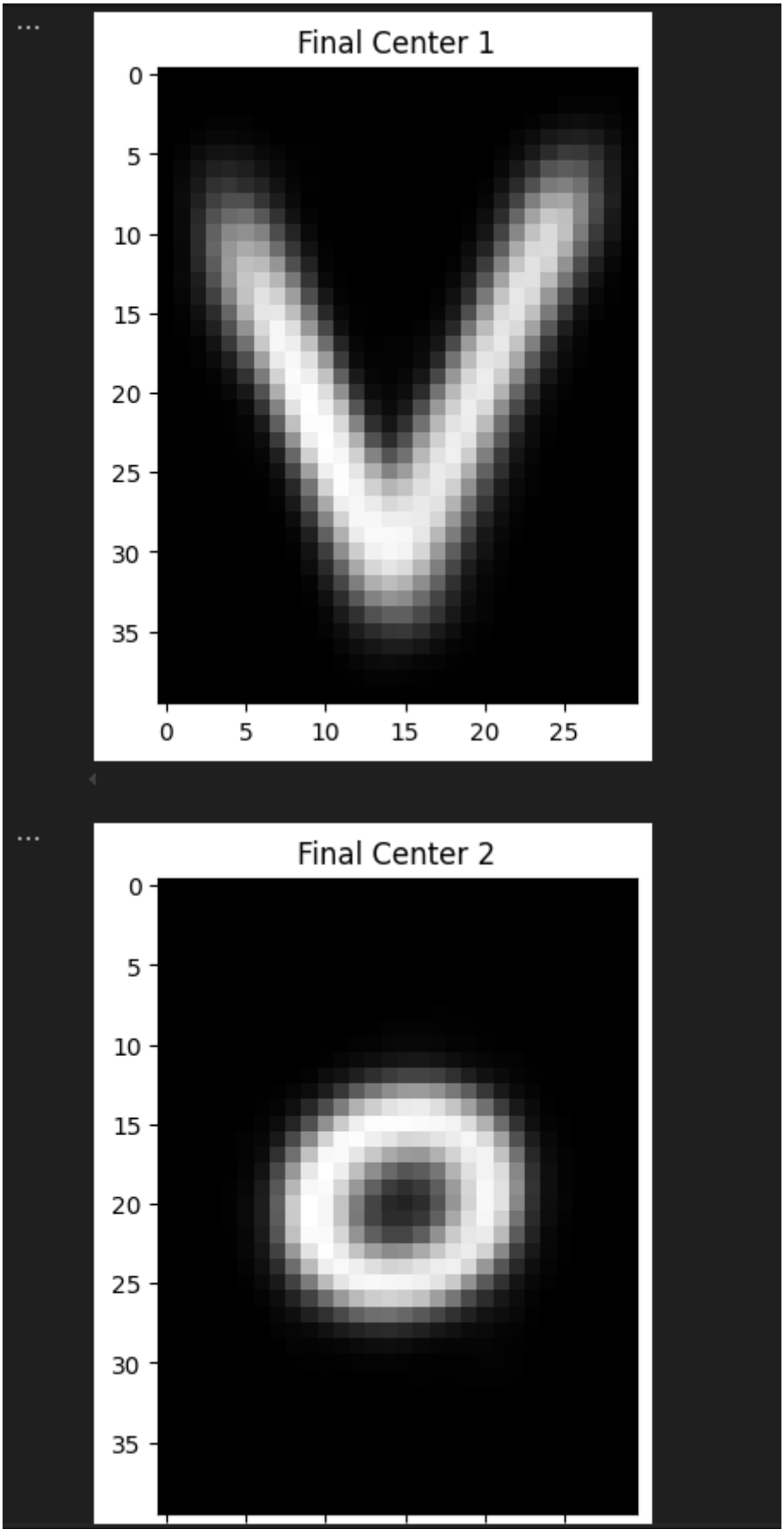

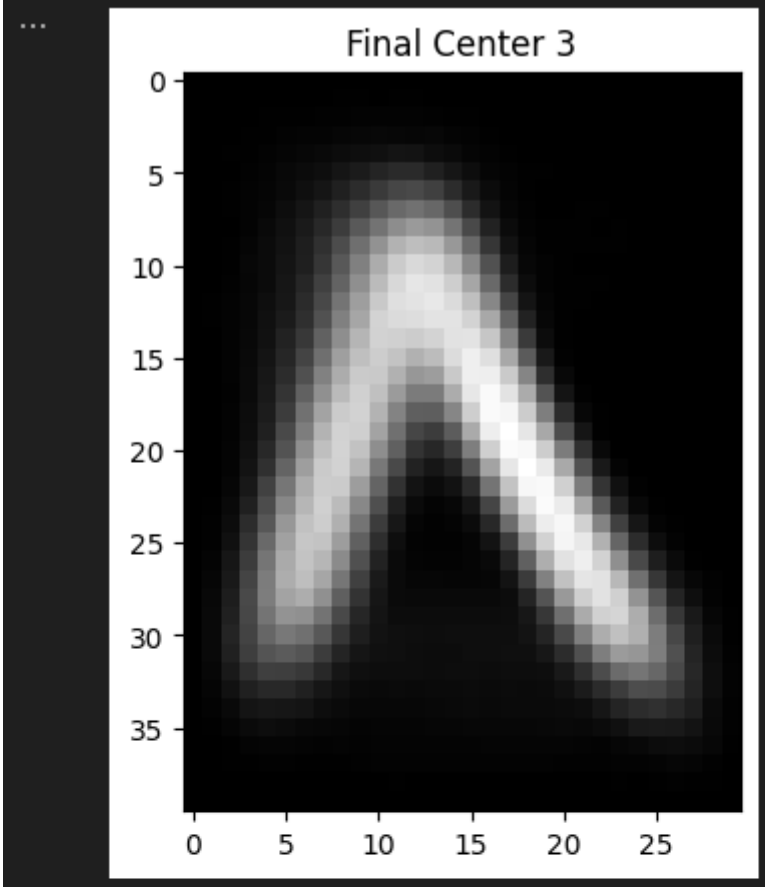
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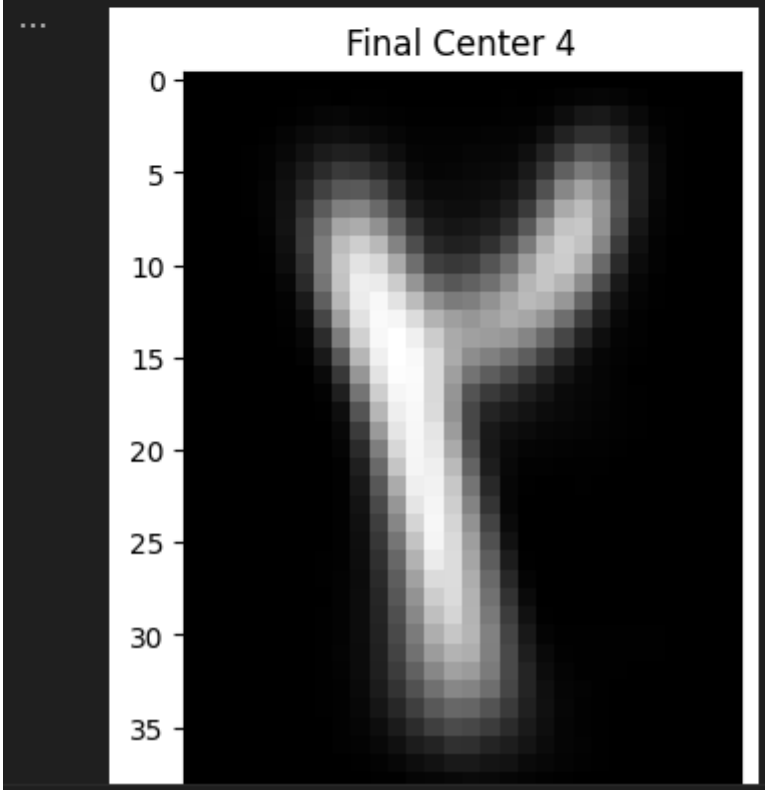
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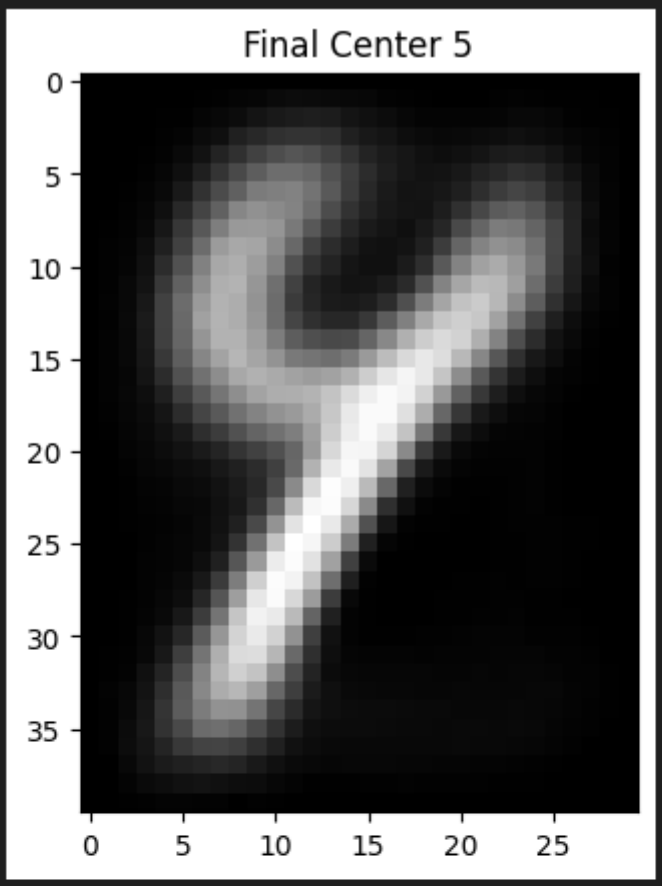
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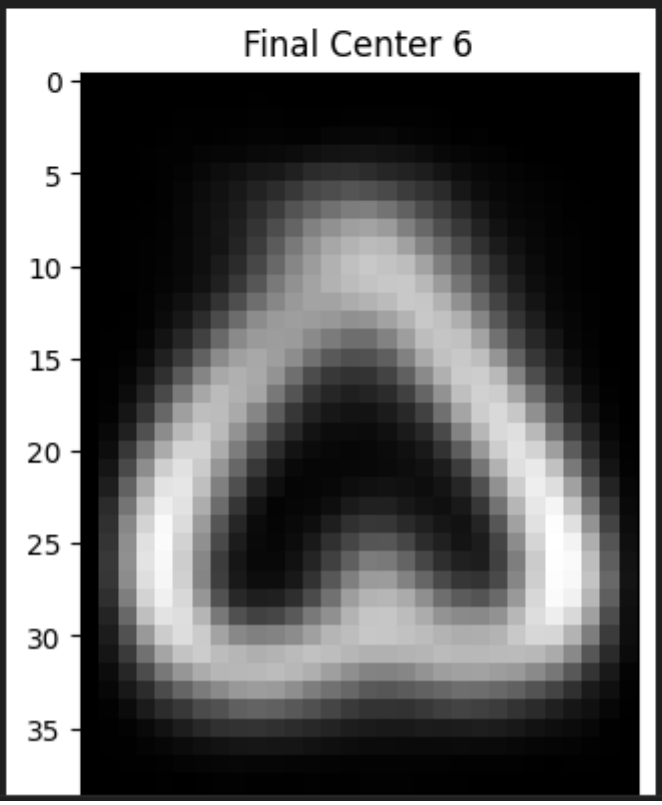
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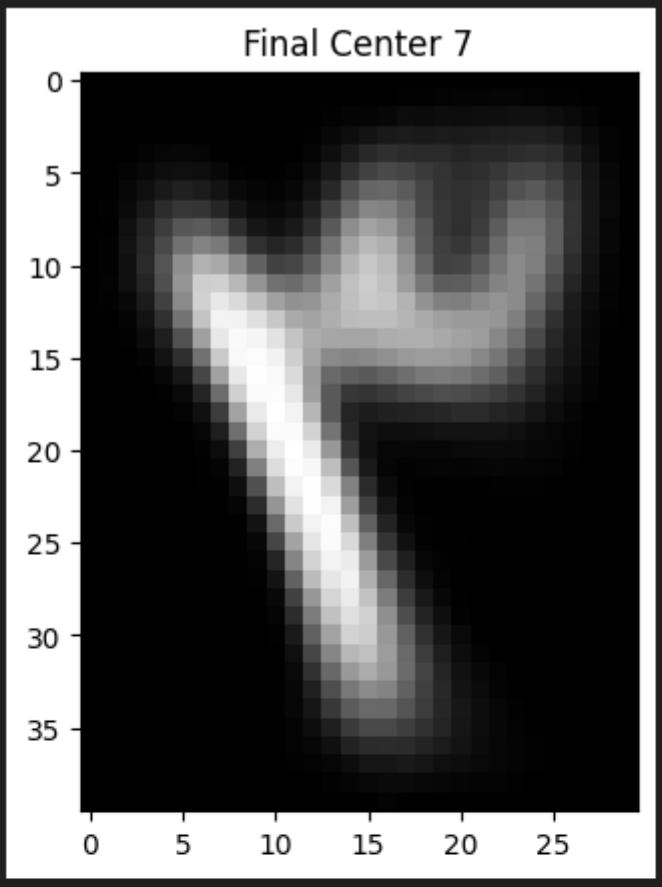
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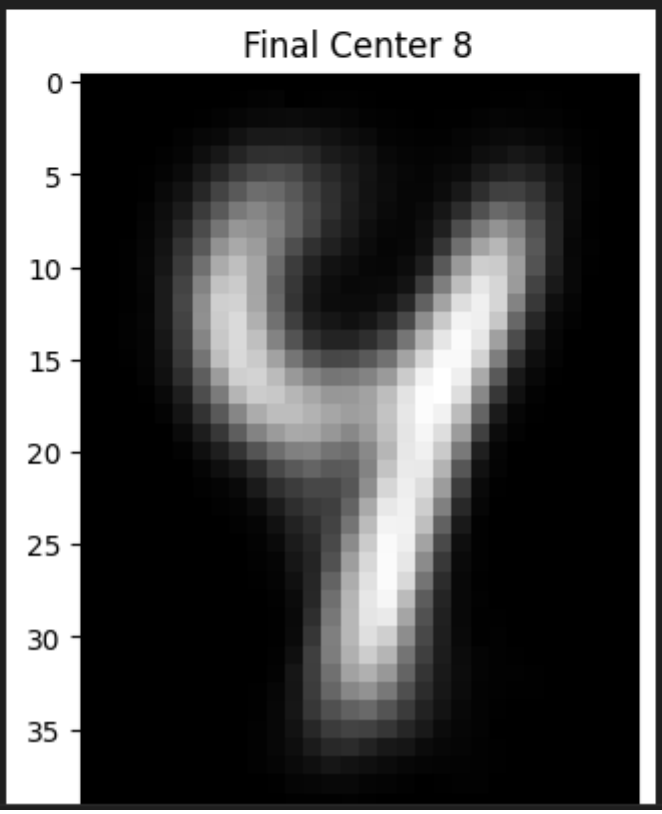
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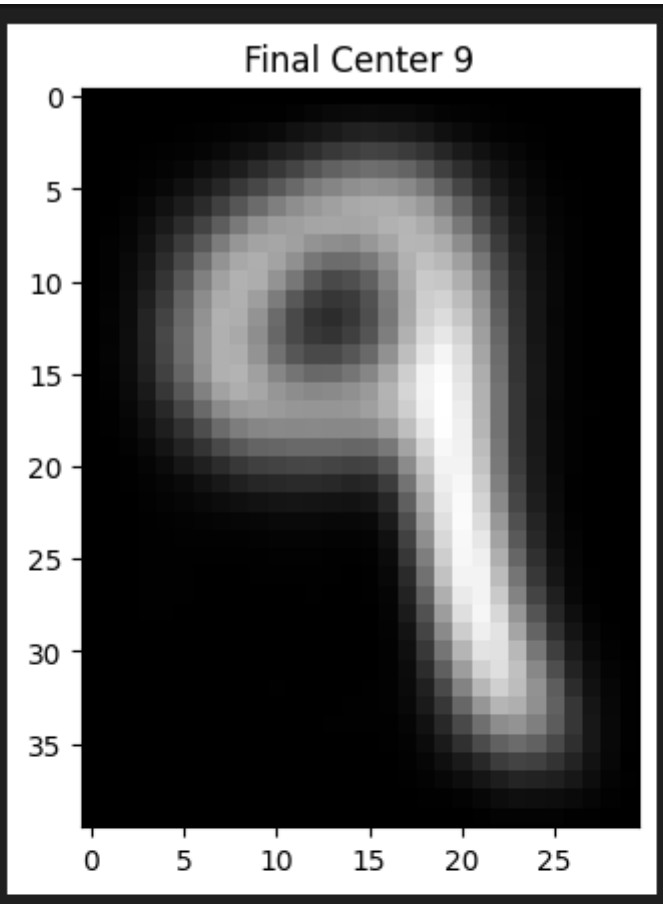
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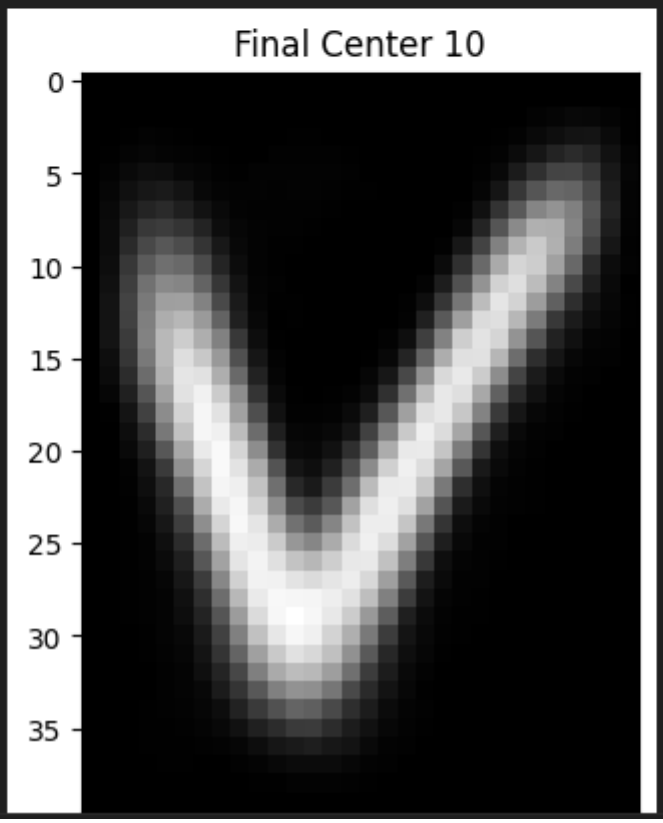
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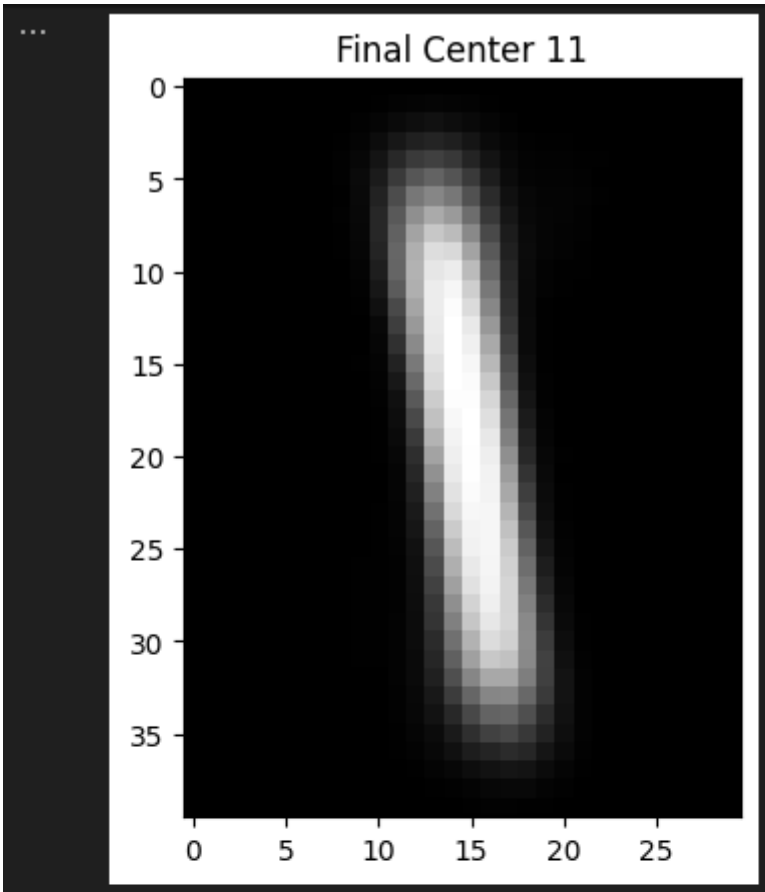
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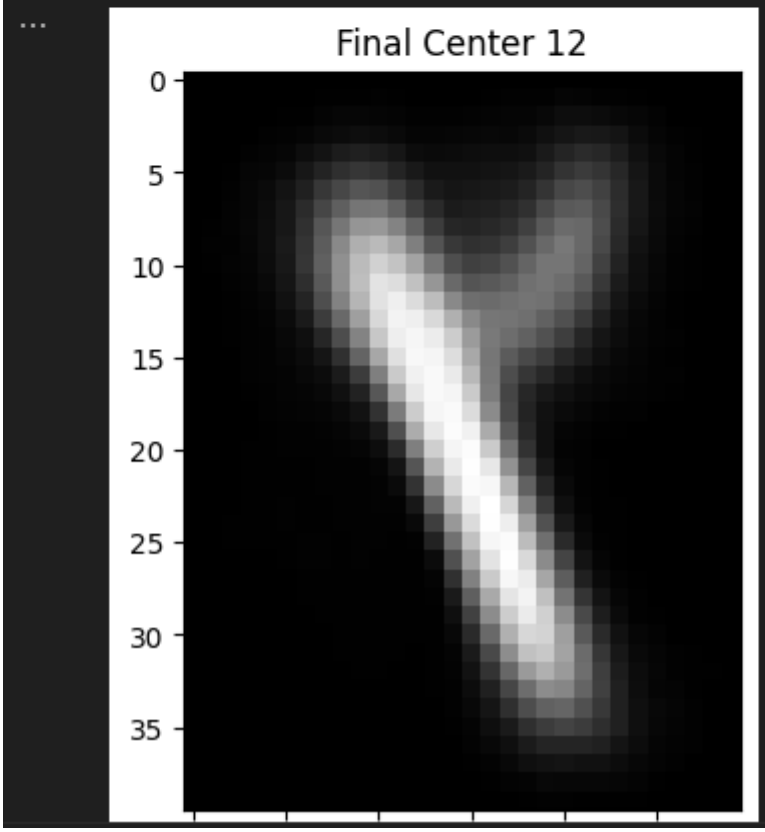
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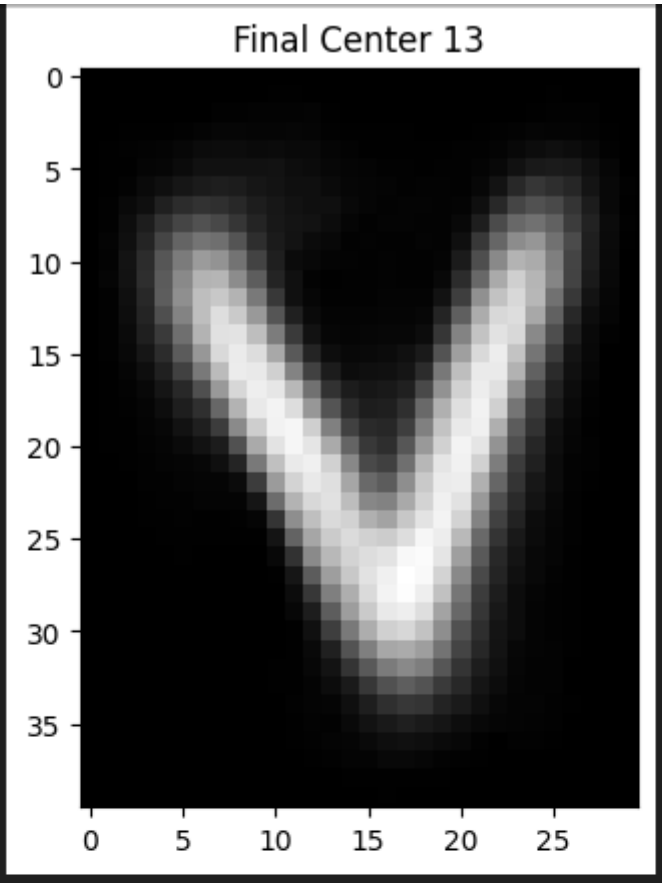
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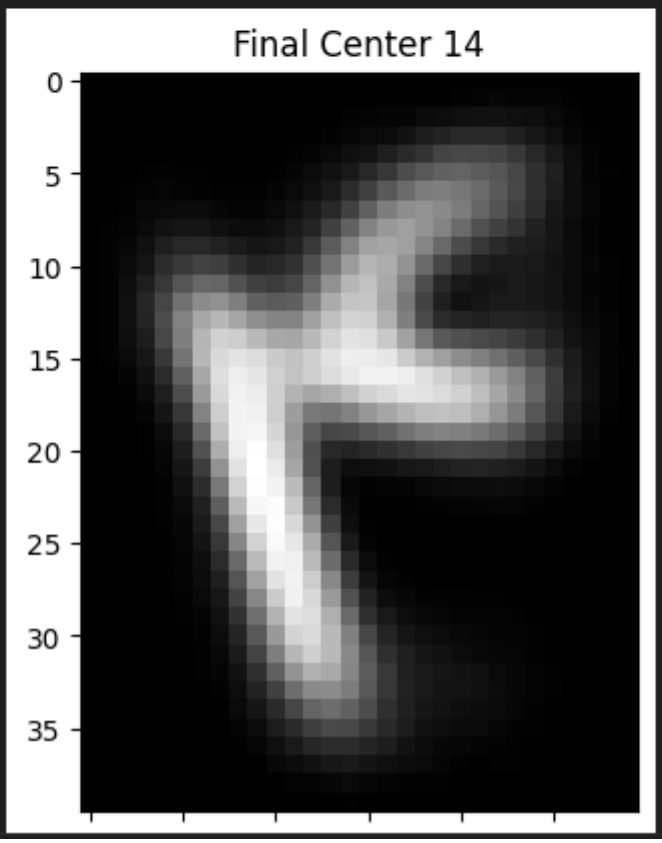
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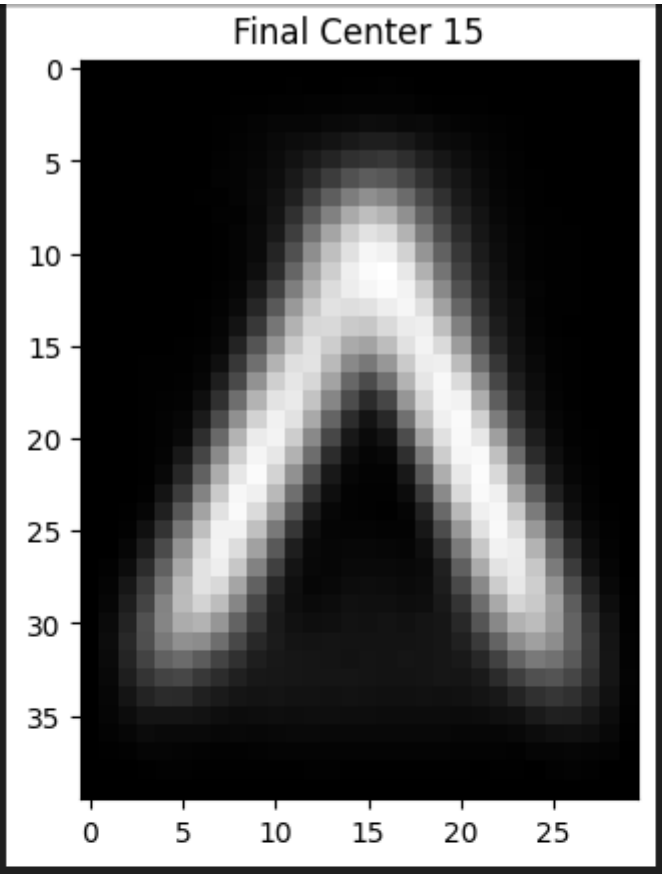
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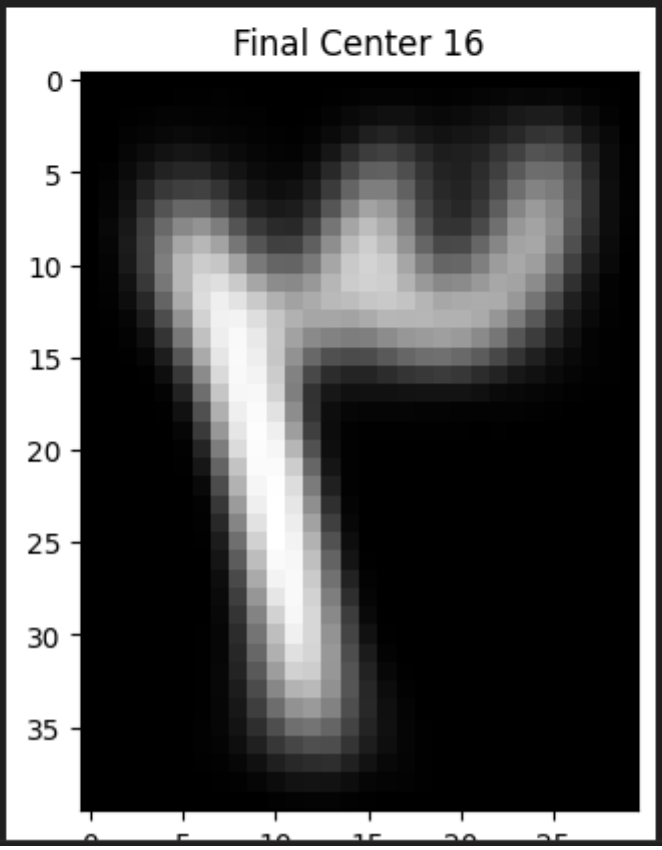
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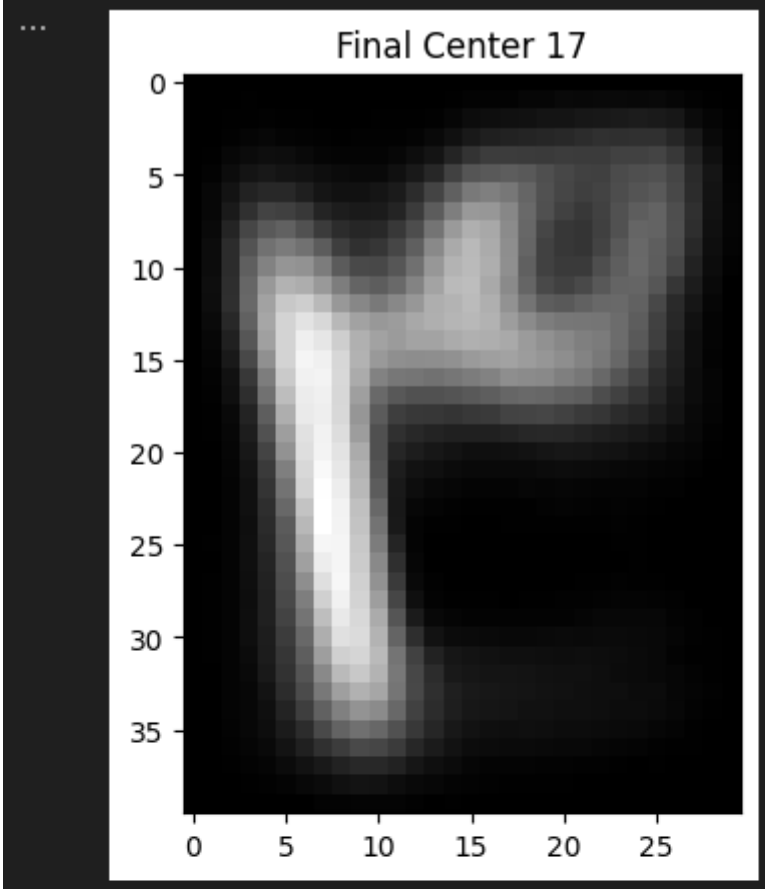
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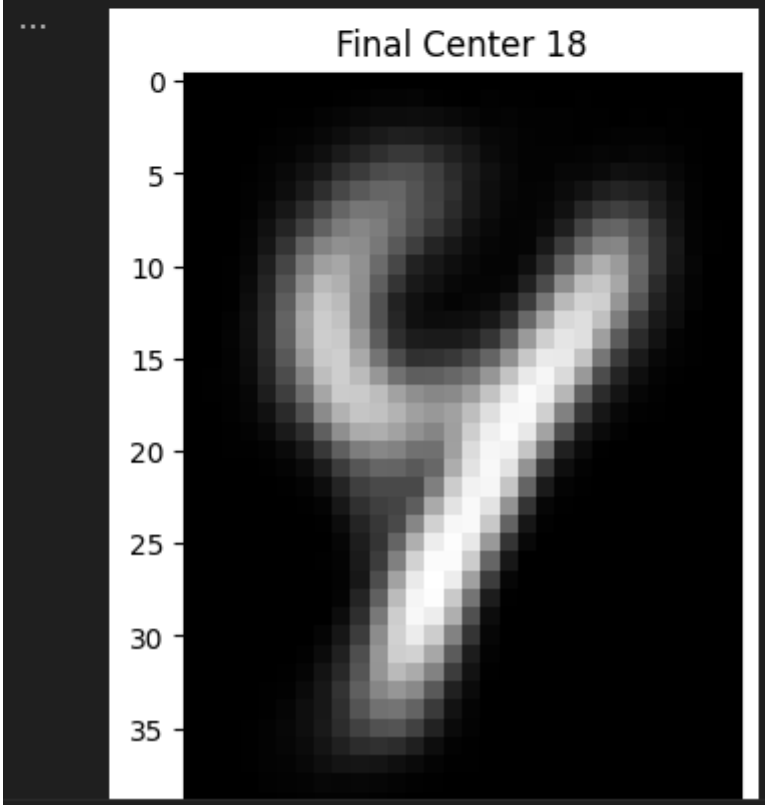
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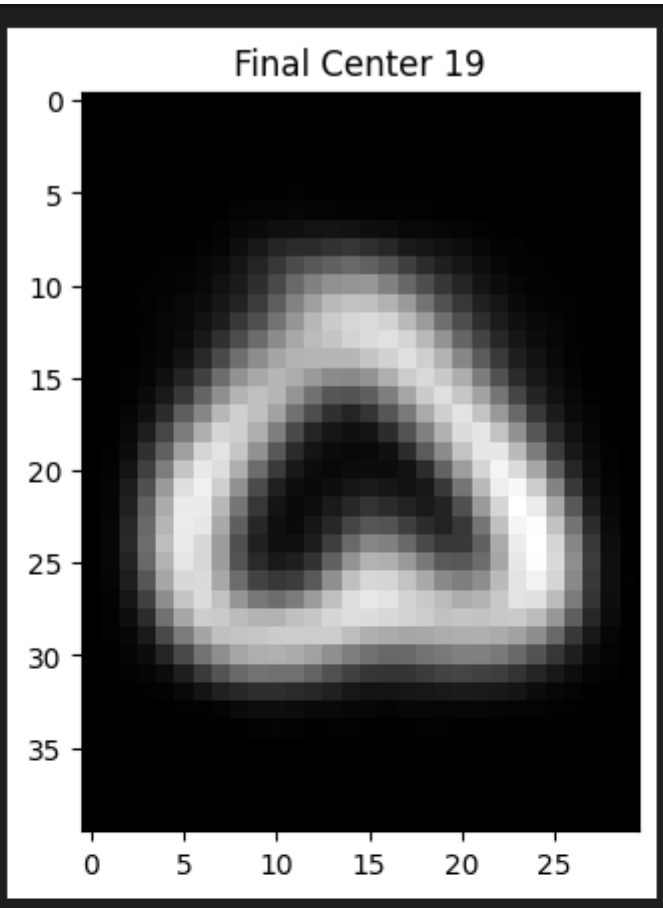
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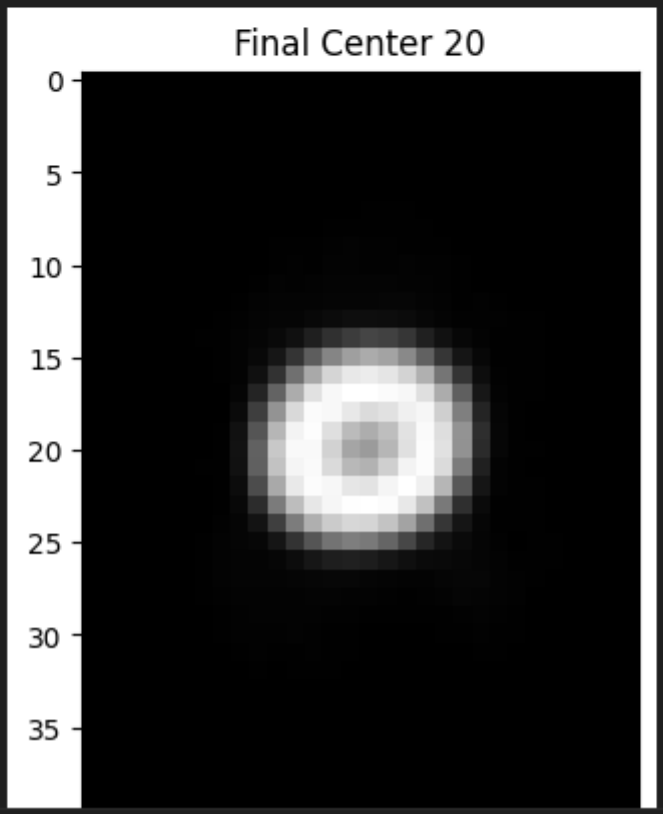
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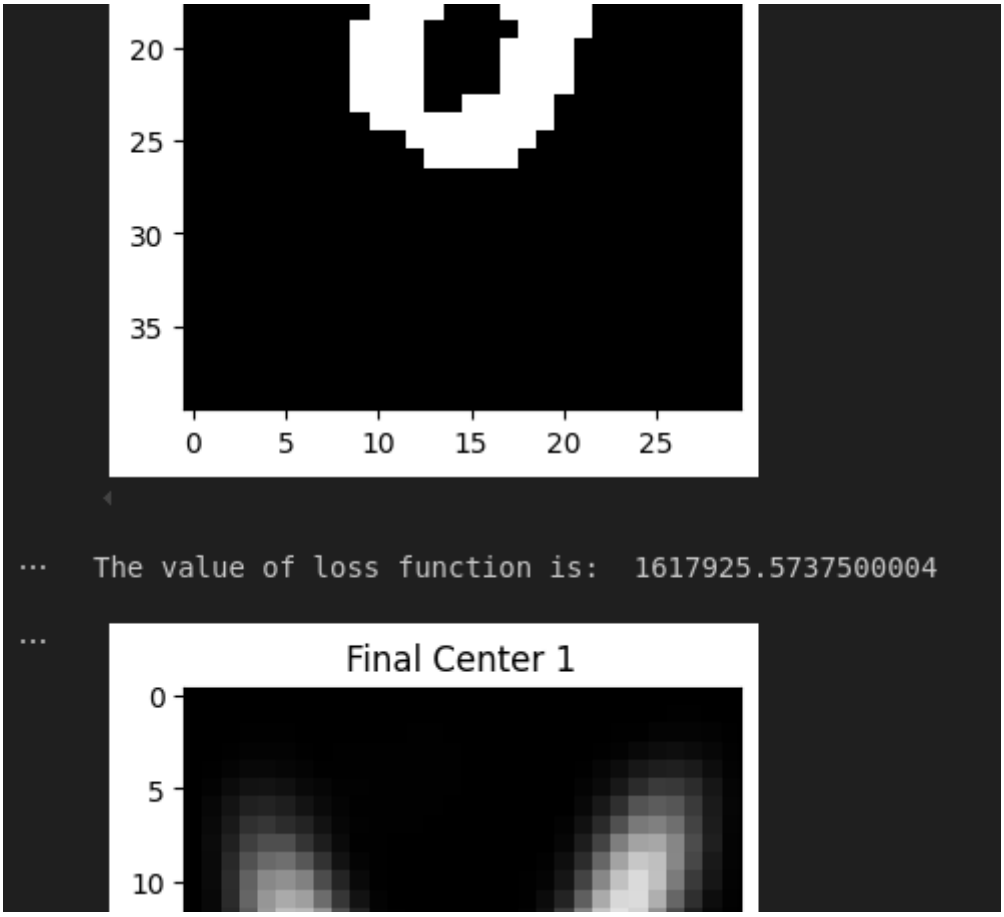
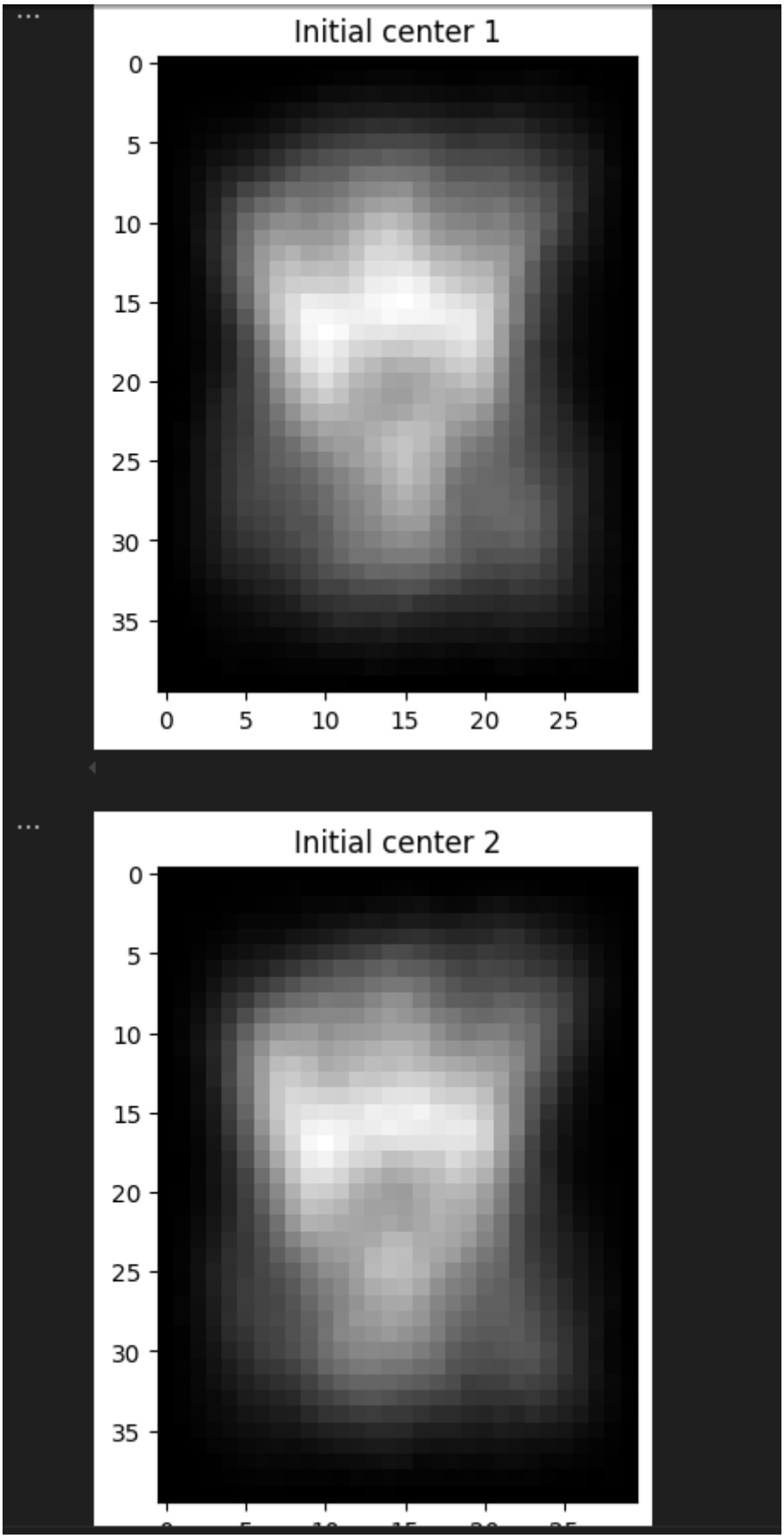
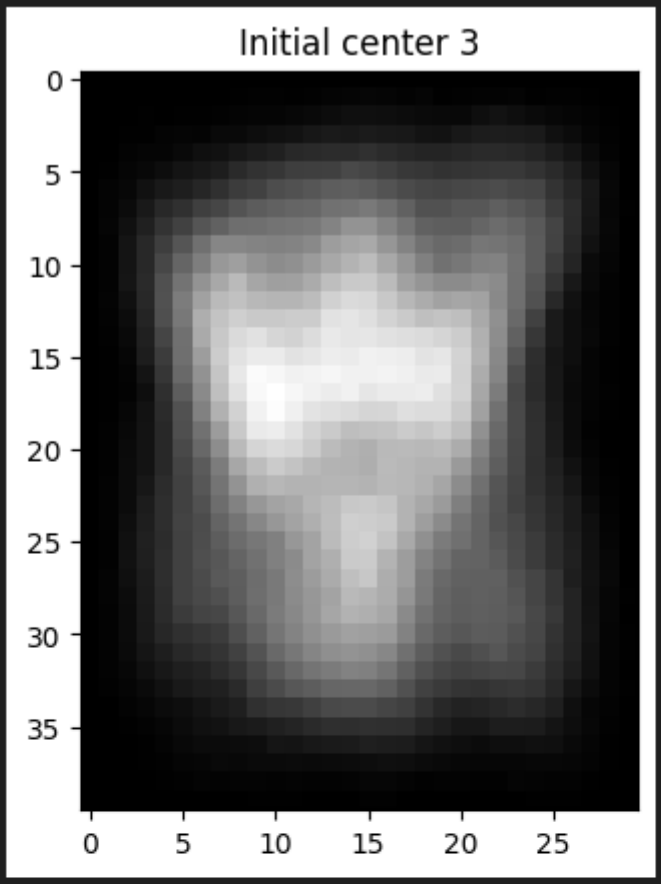
مقدار تابع هزینه



b.III:

شاخص های اولیه ساخت شده با میانگین هر قسمت

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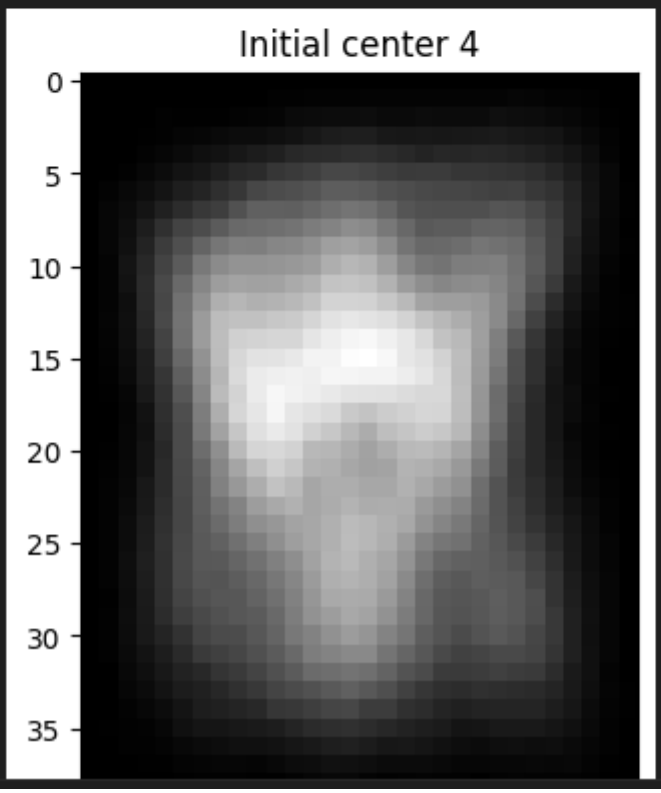
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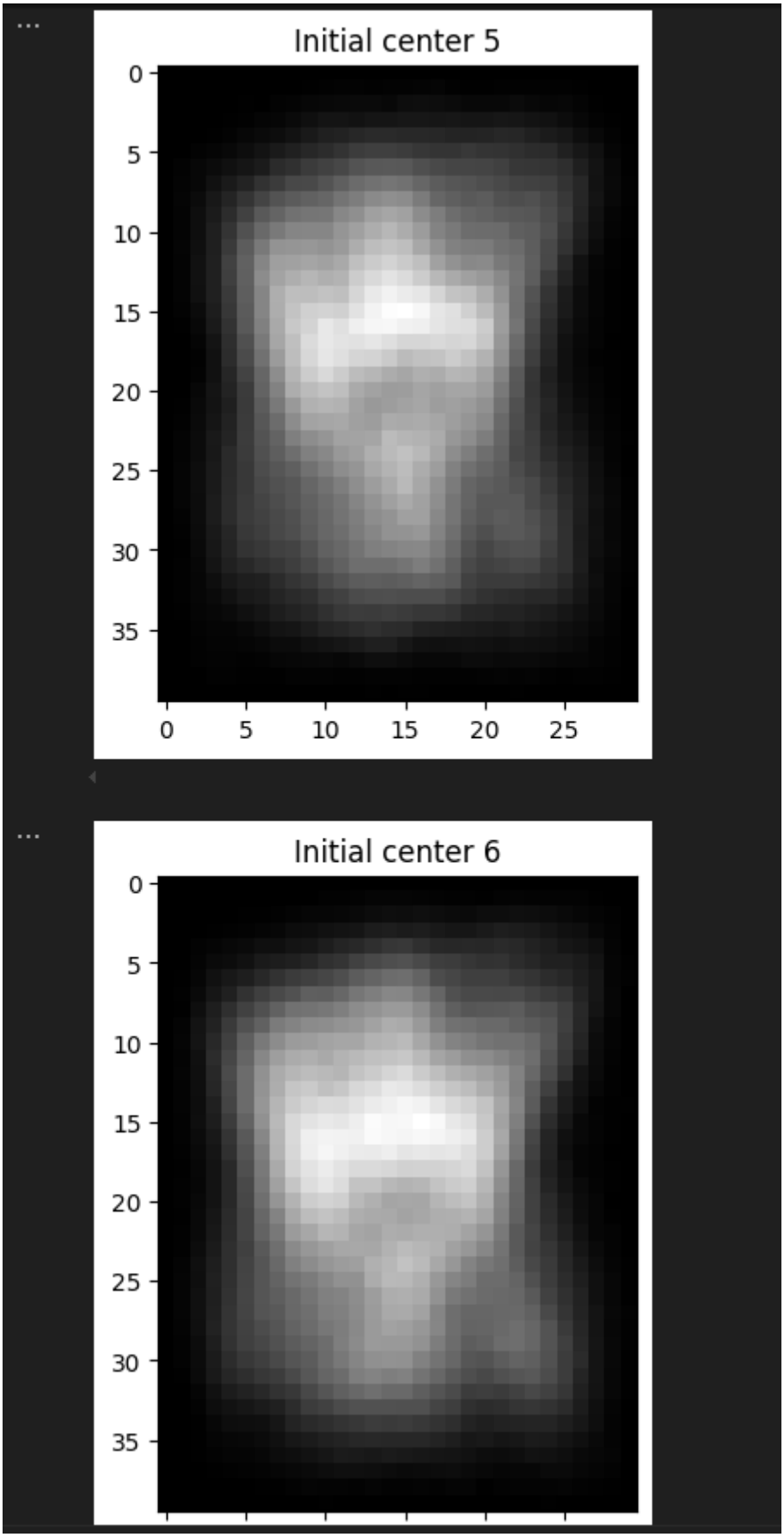
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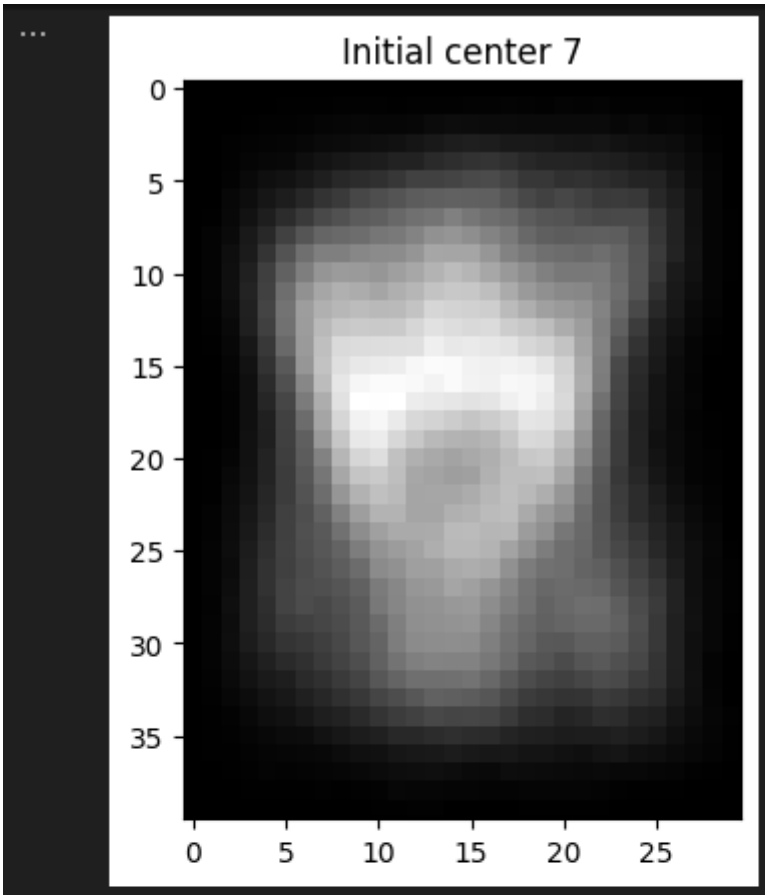
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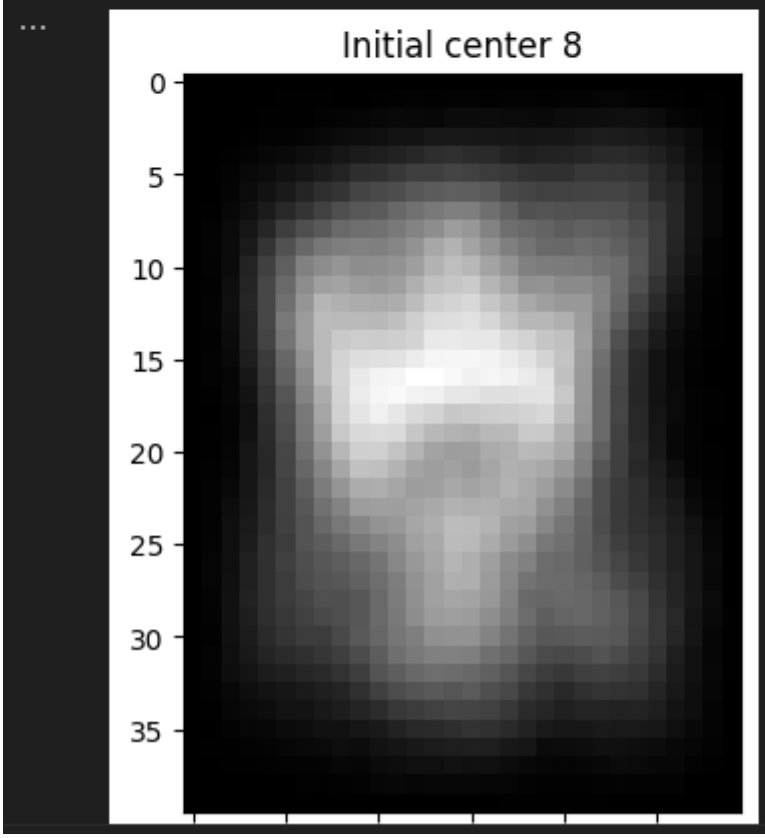
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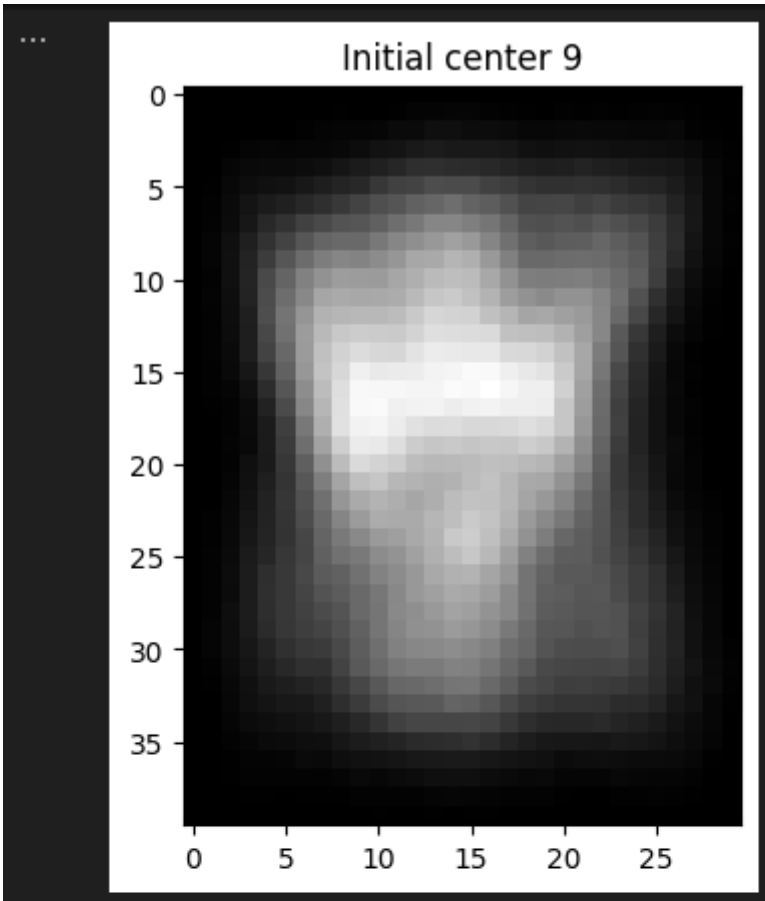
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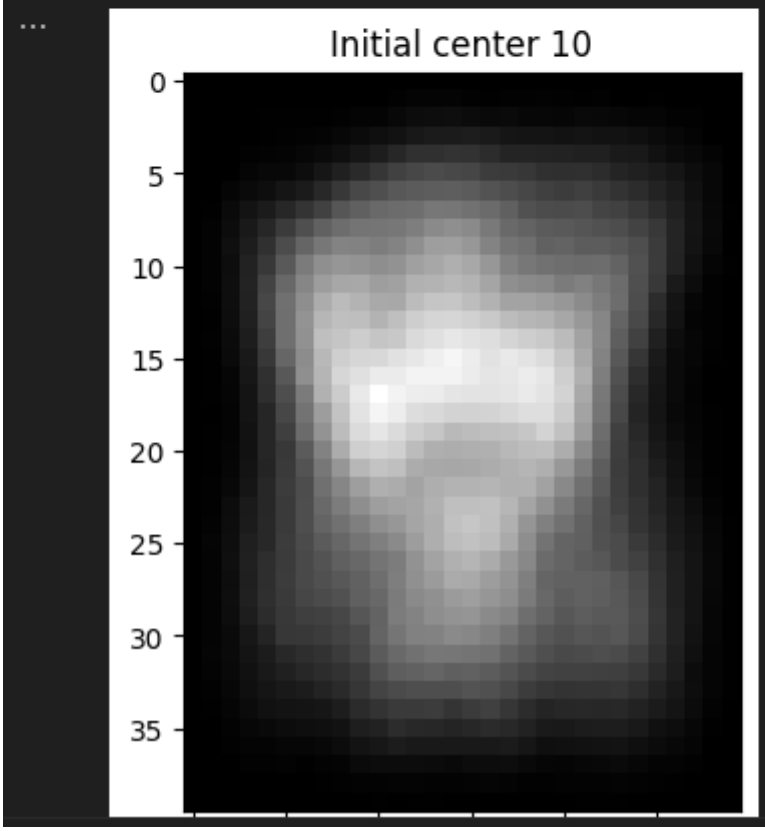
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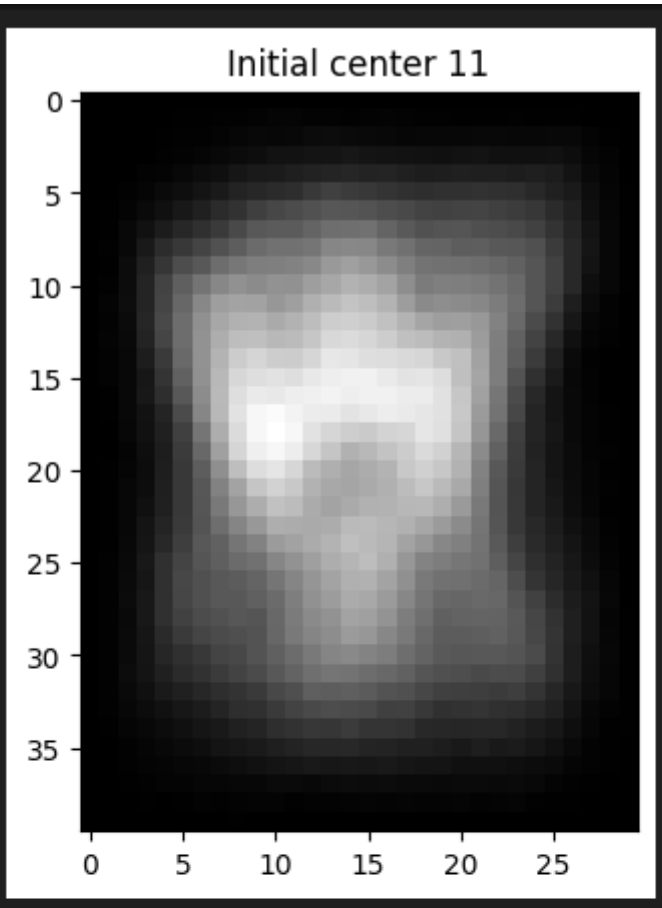
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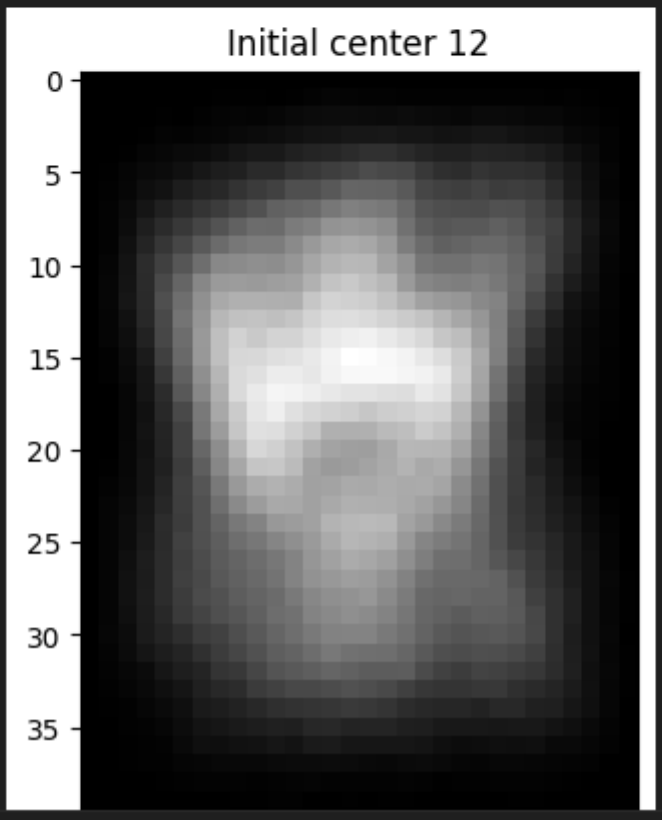
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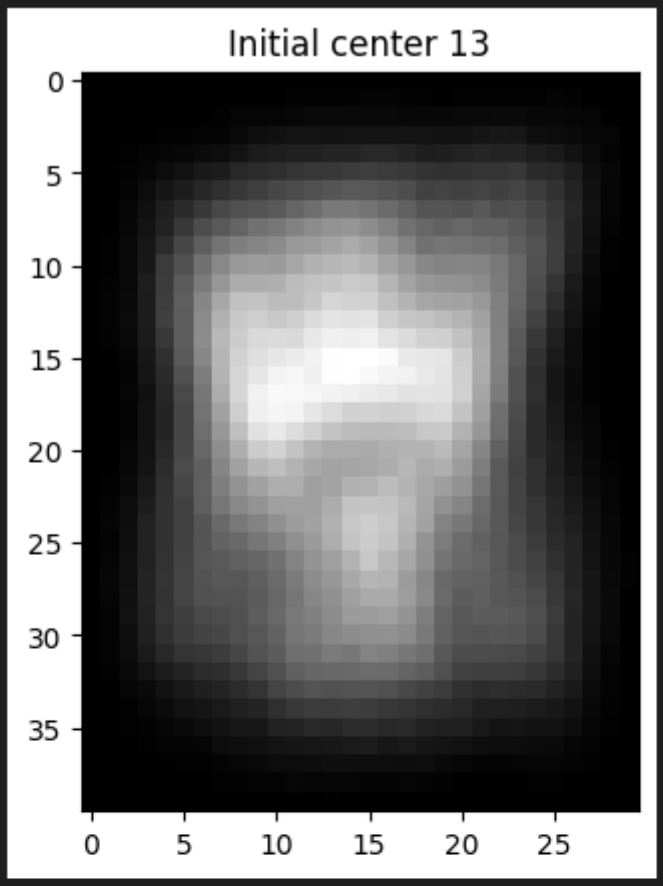
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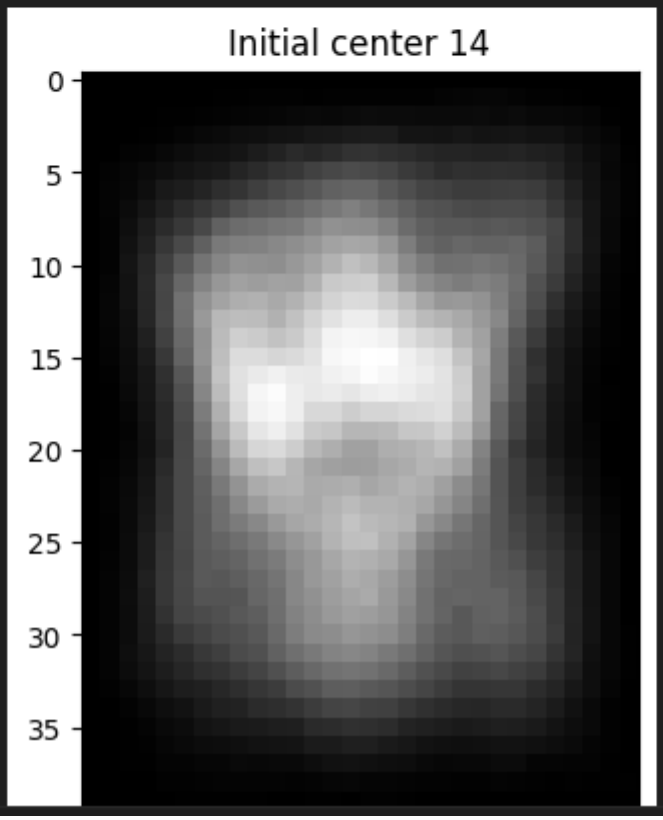
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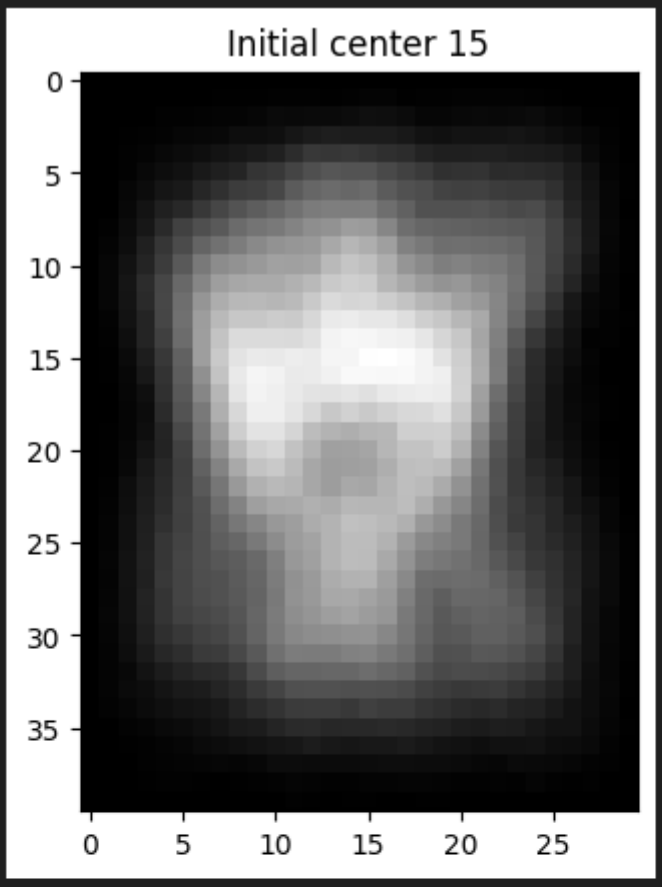
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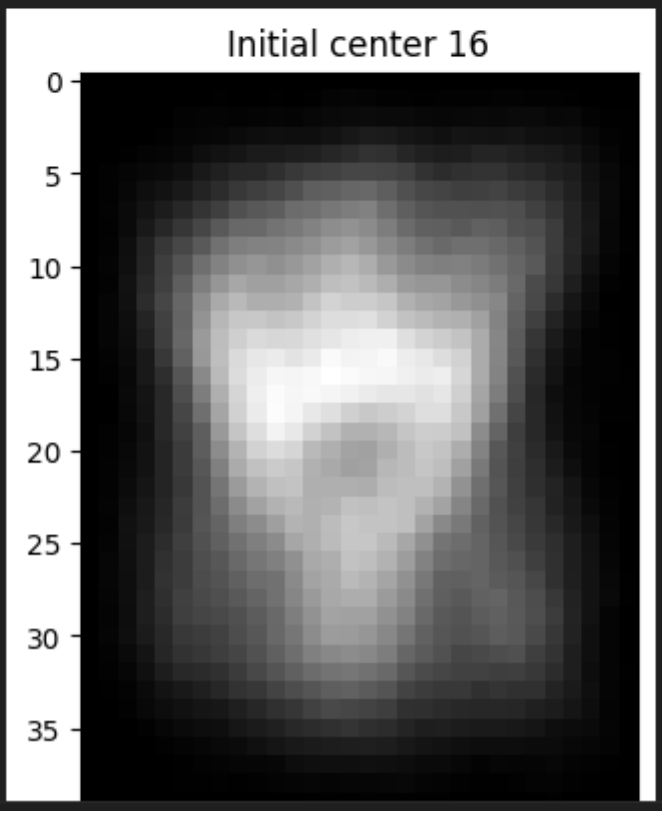
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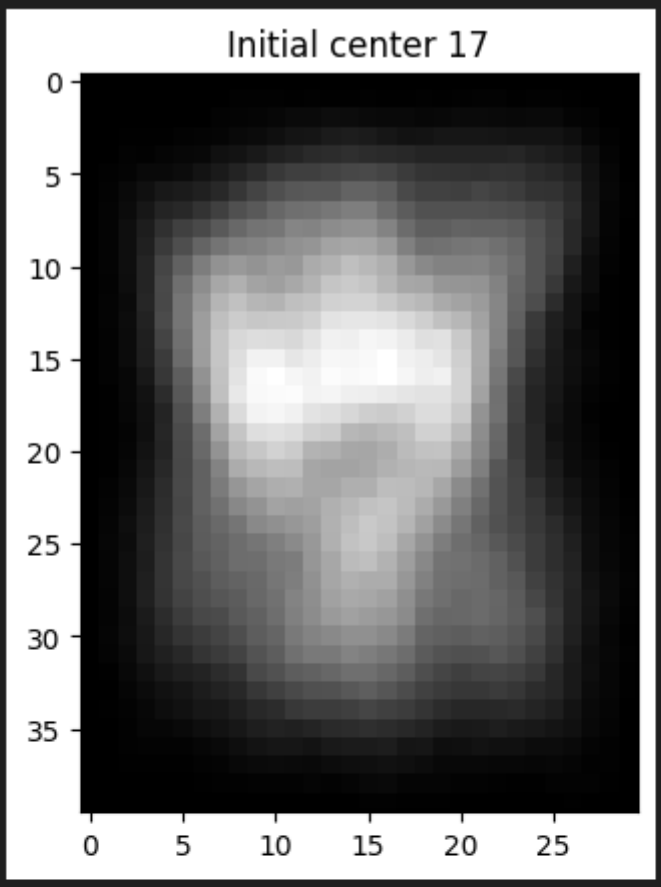
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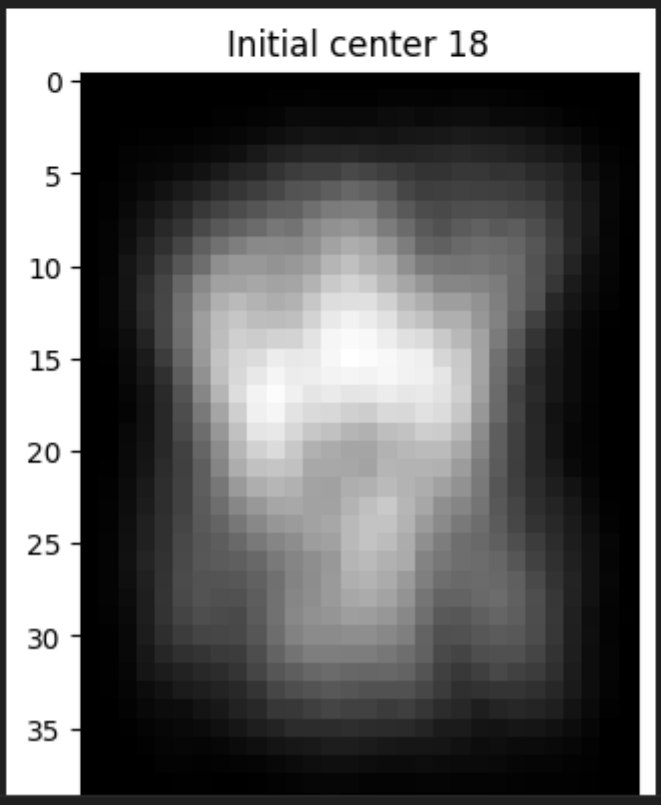
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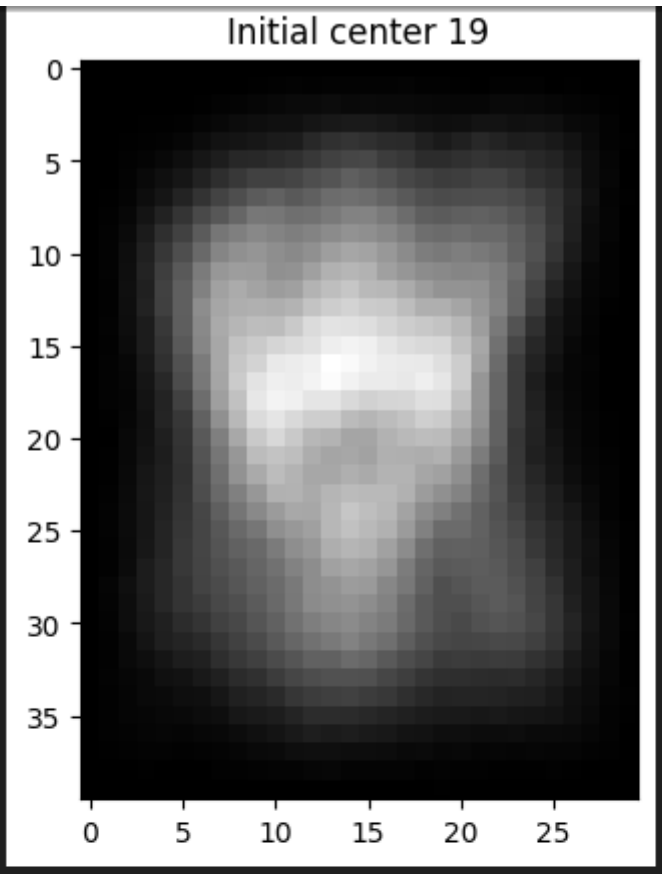
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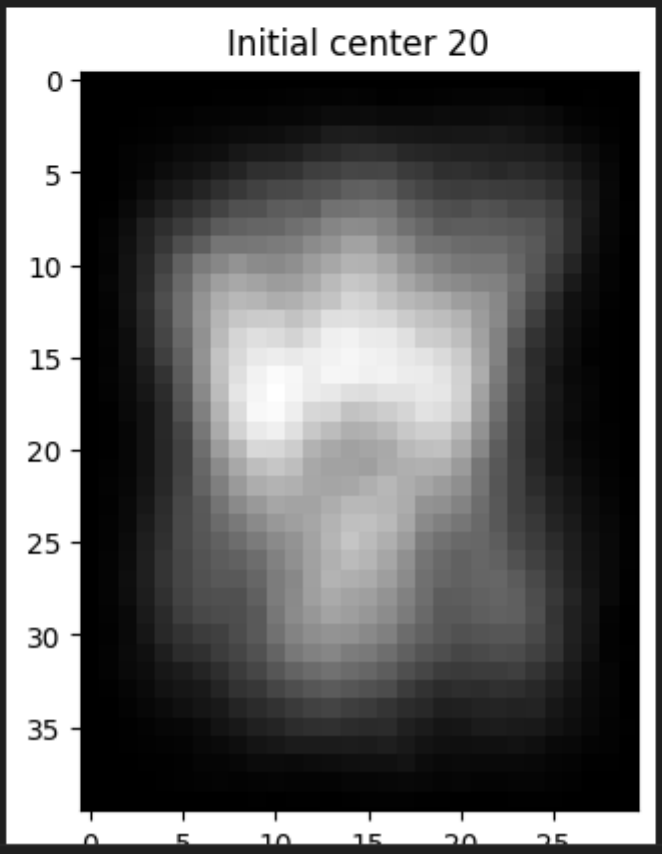
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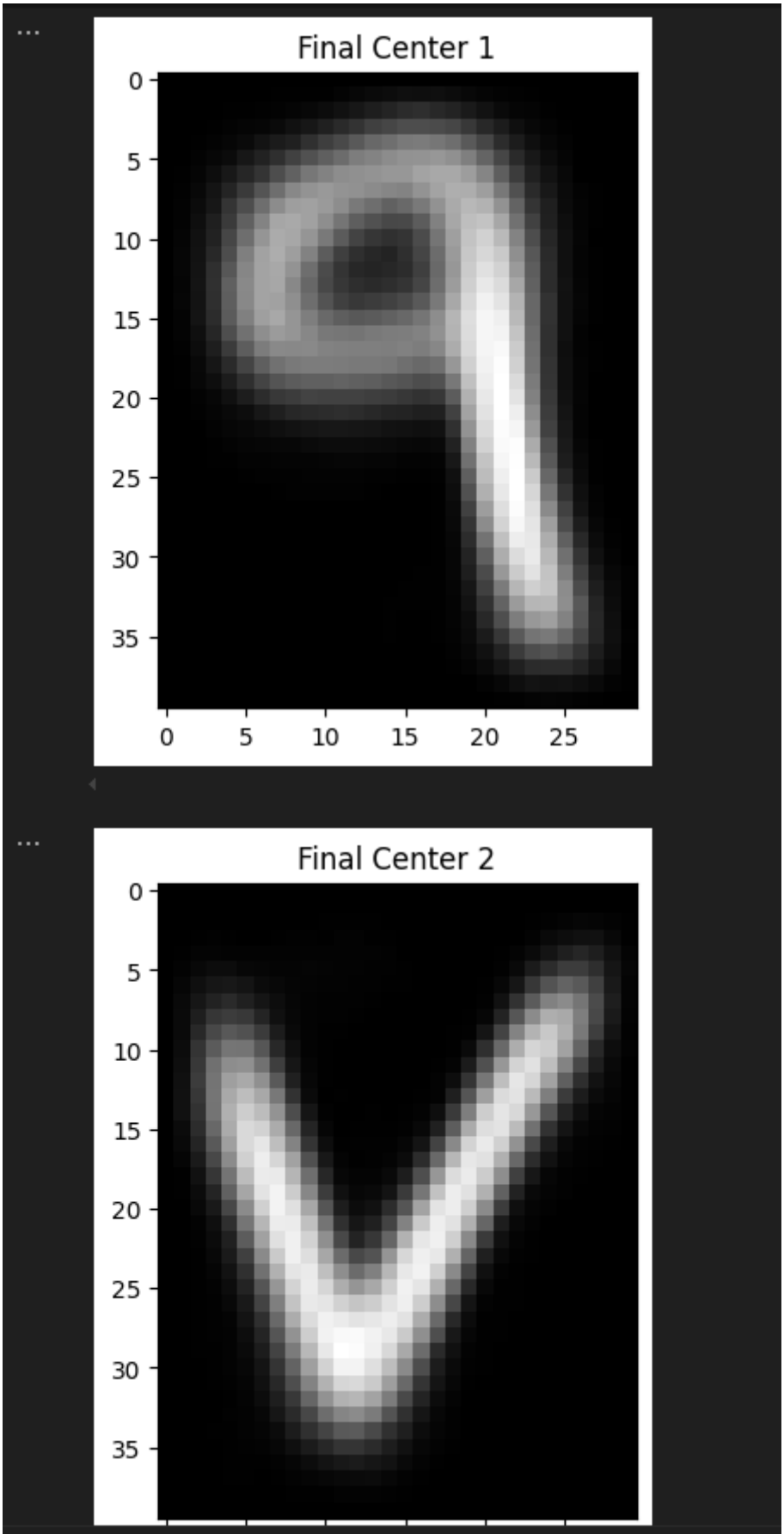
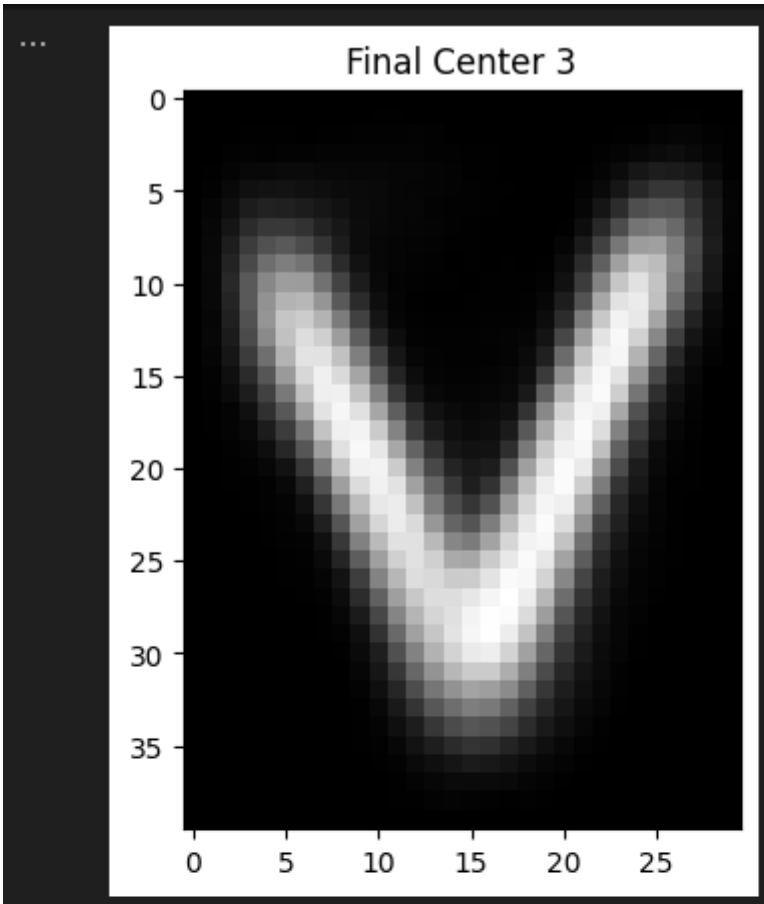
شاخص های نهایی

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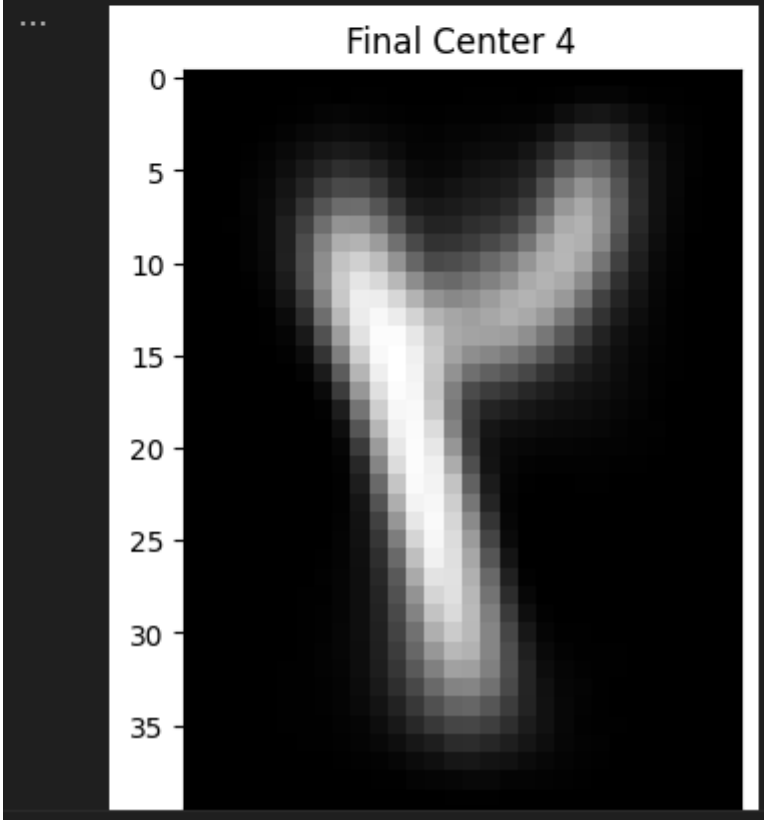
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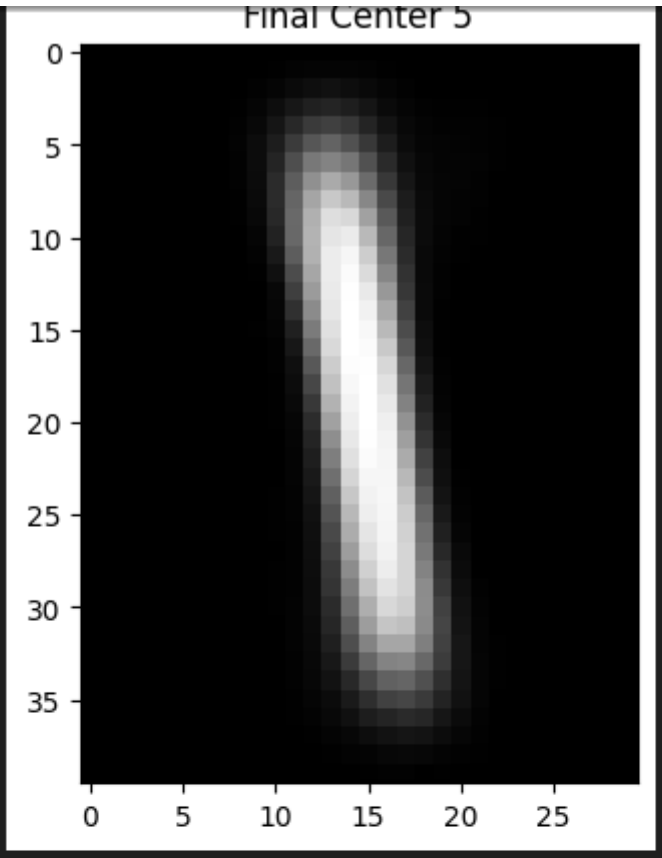
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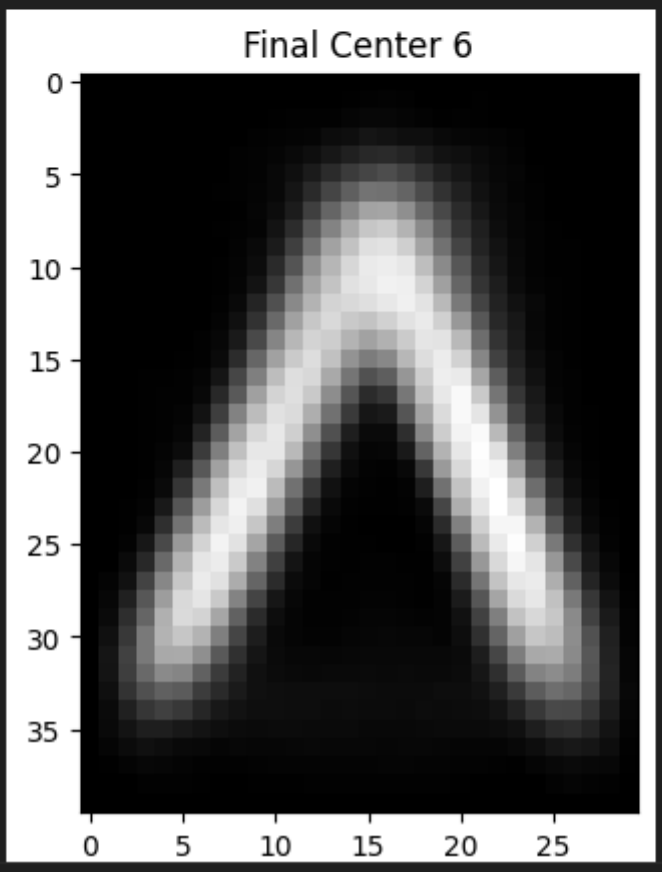
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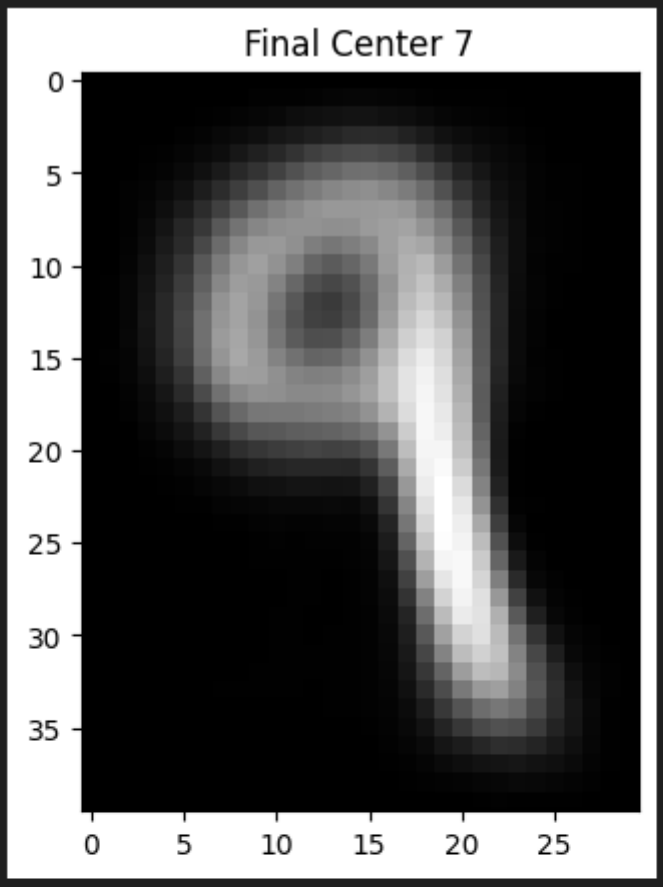
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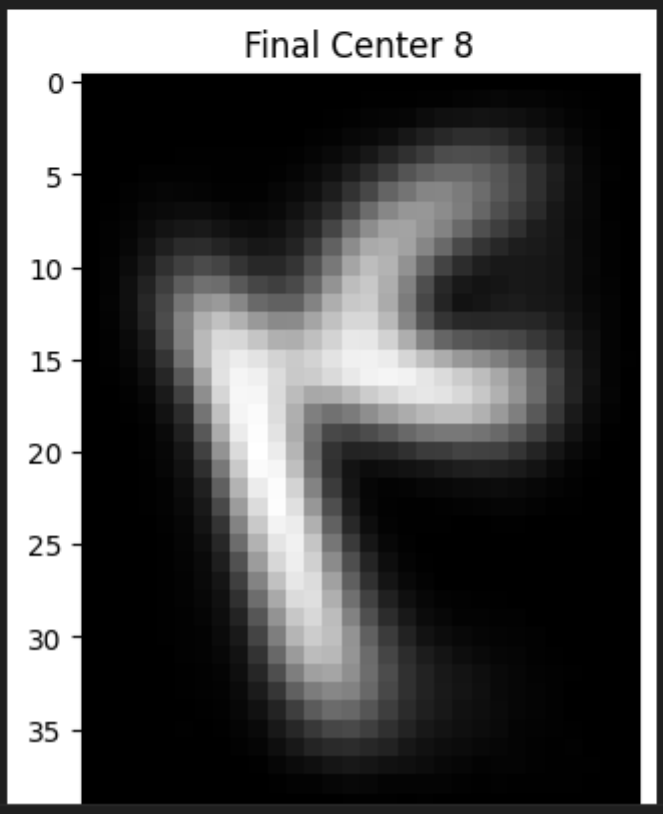
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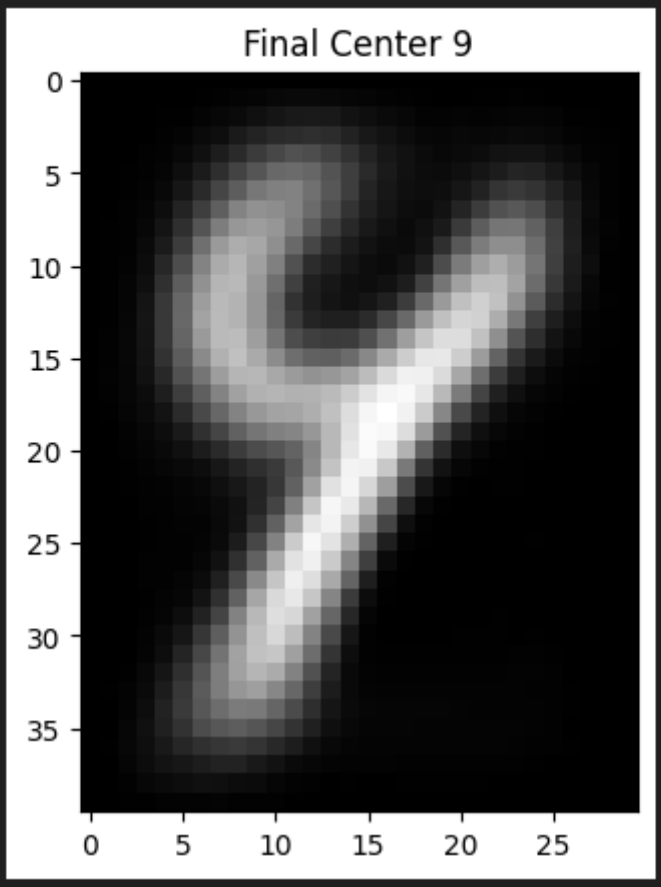
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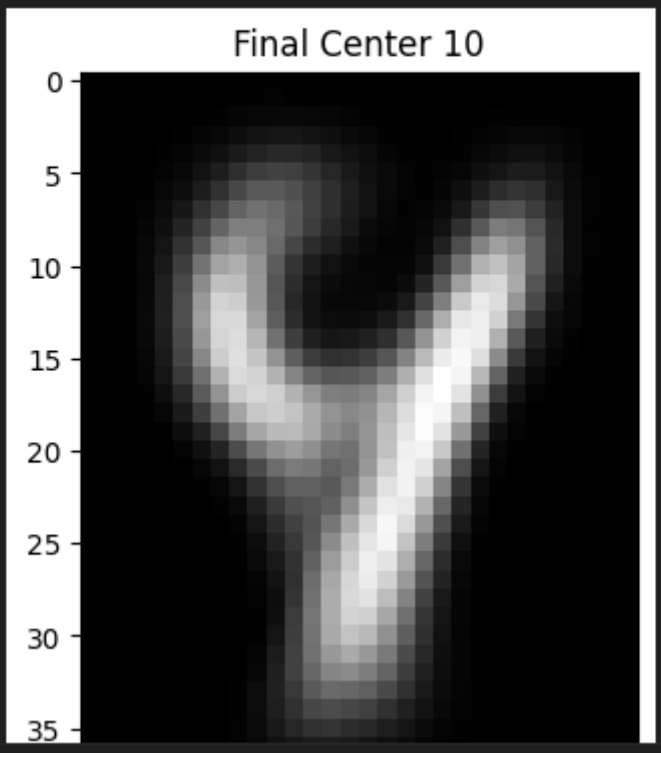
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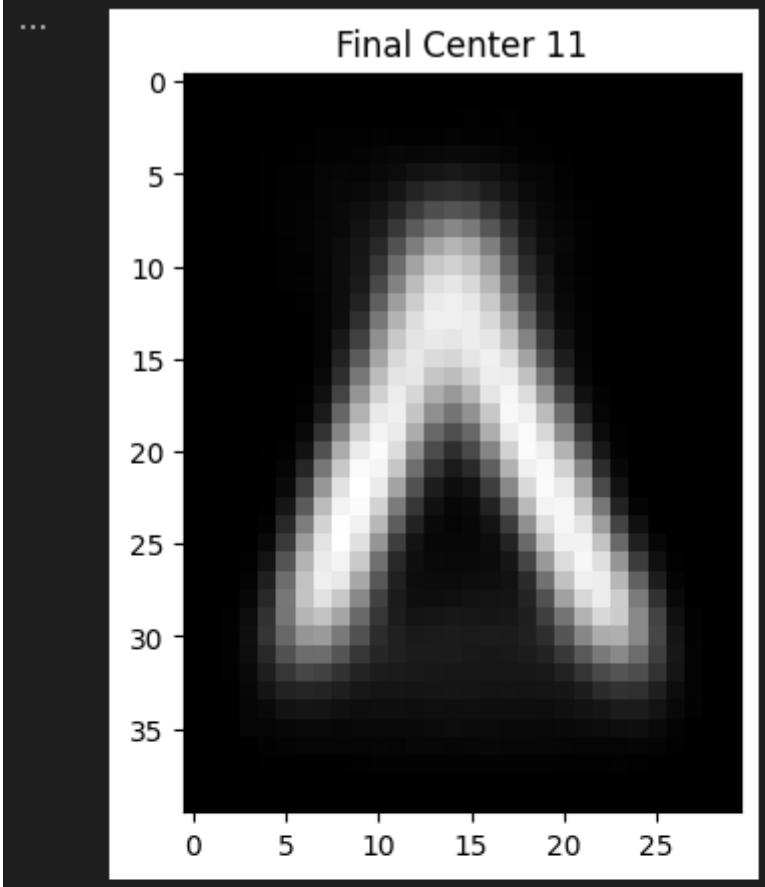
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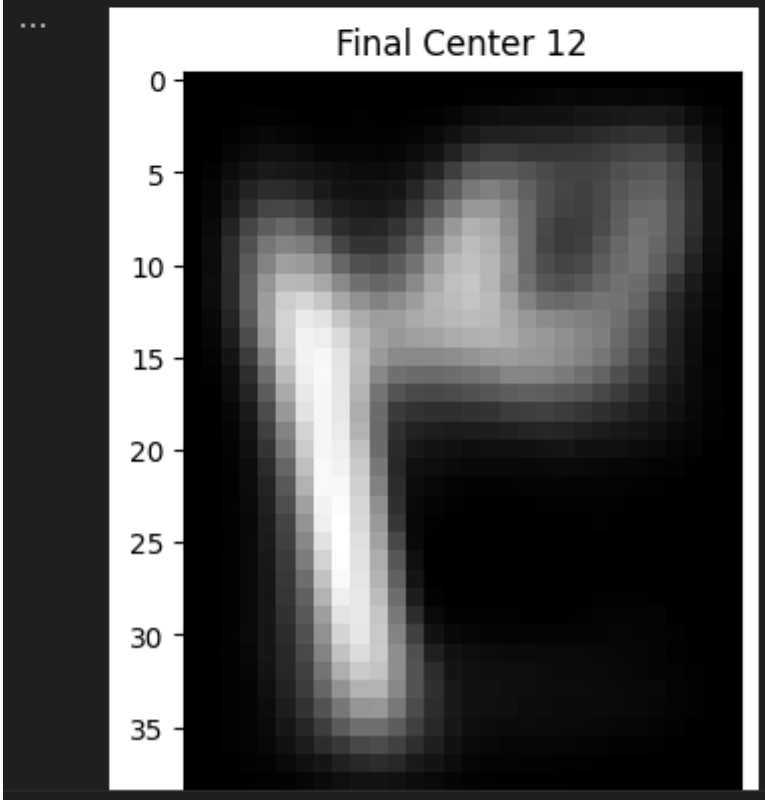
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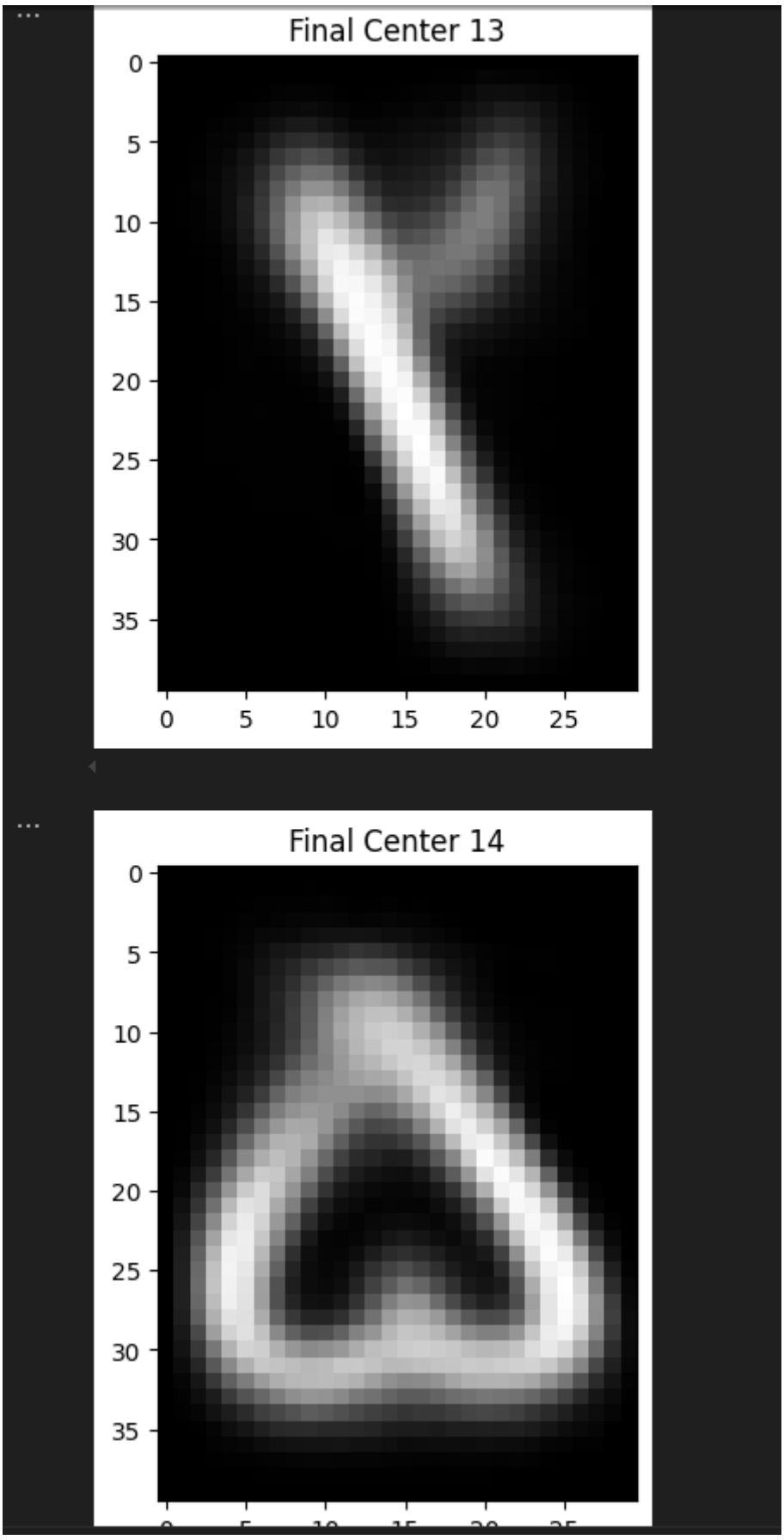
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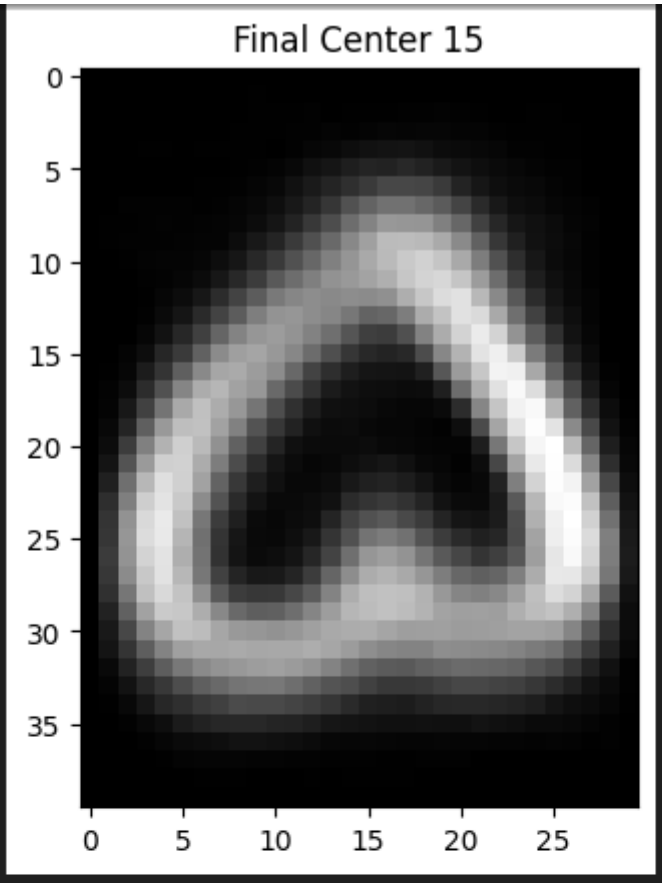
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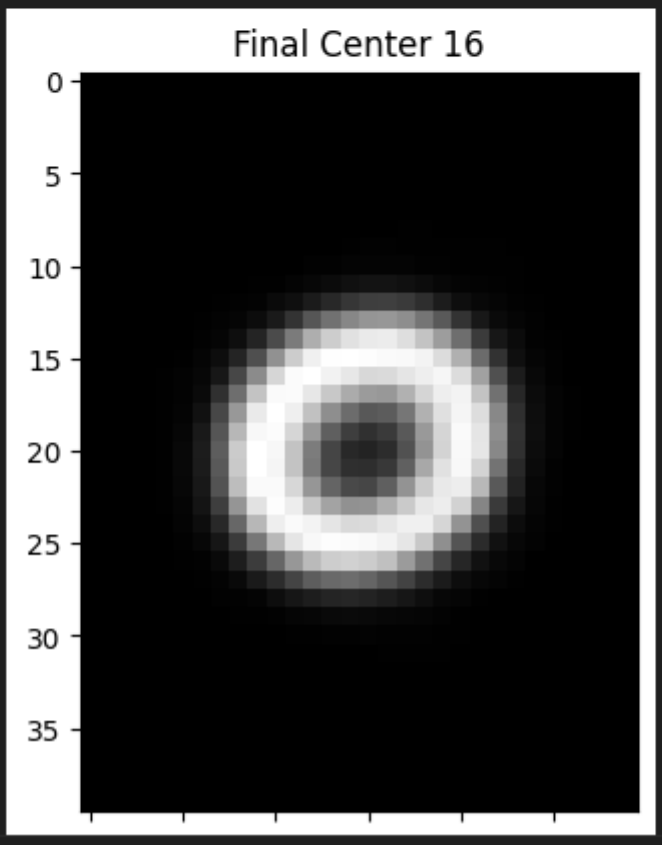
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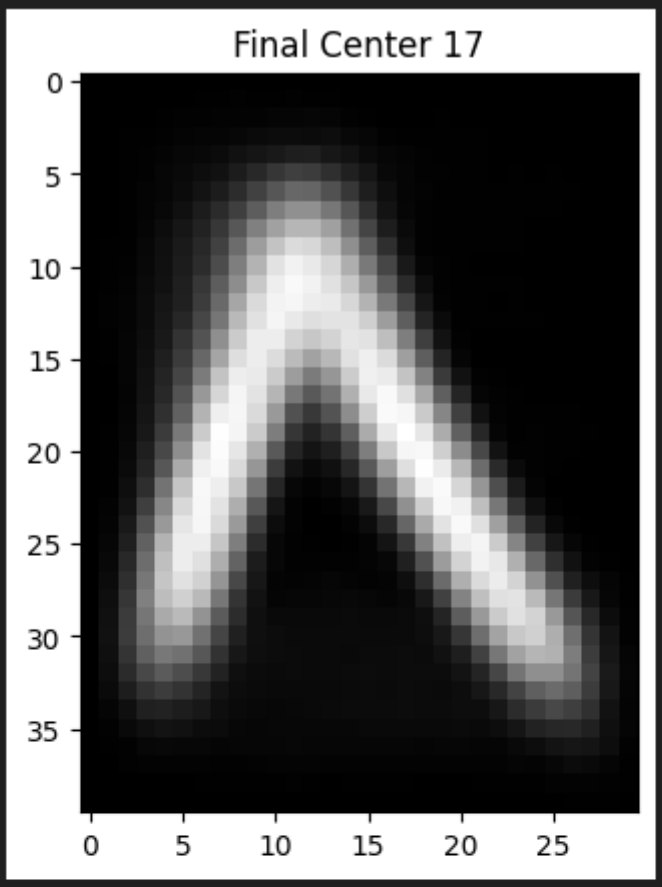
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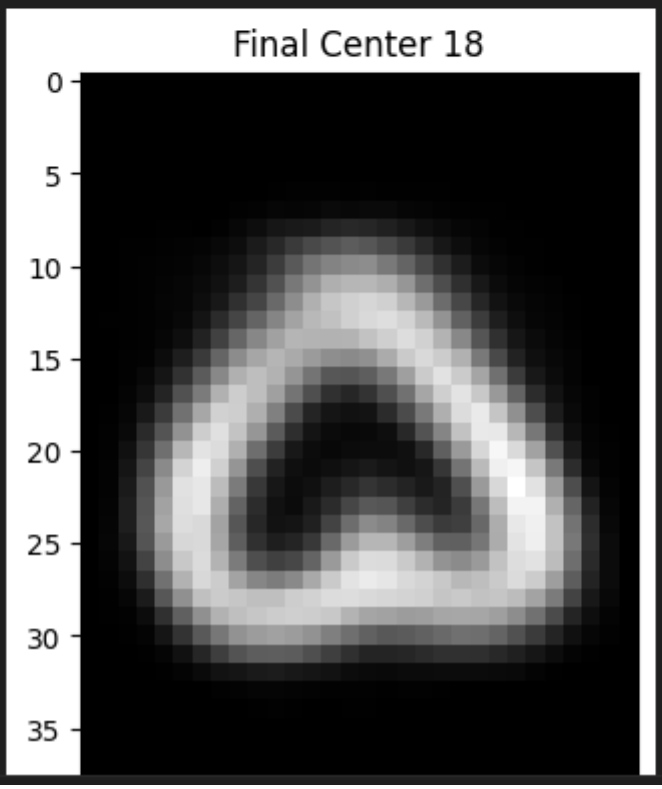
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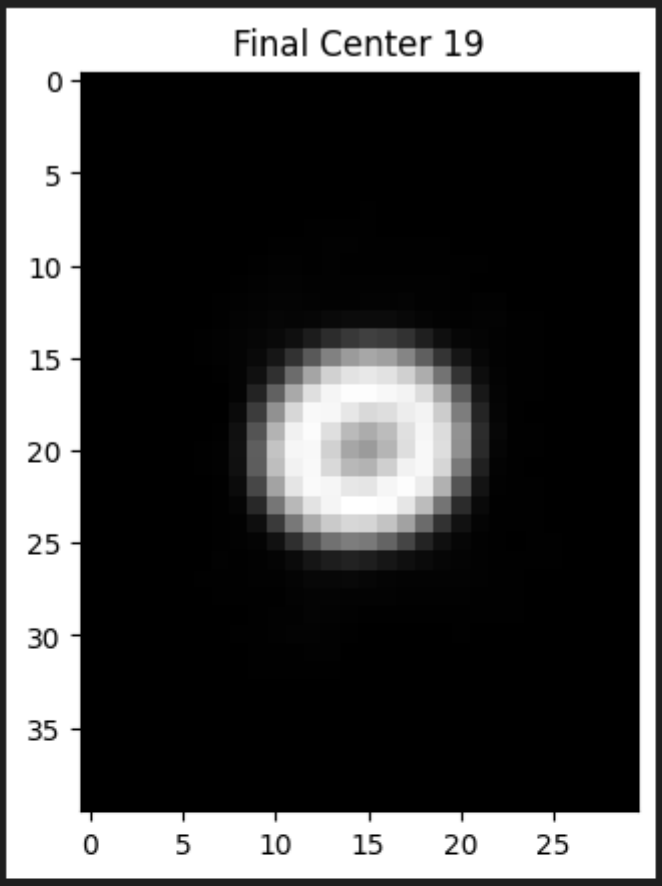
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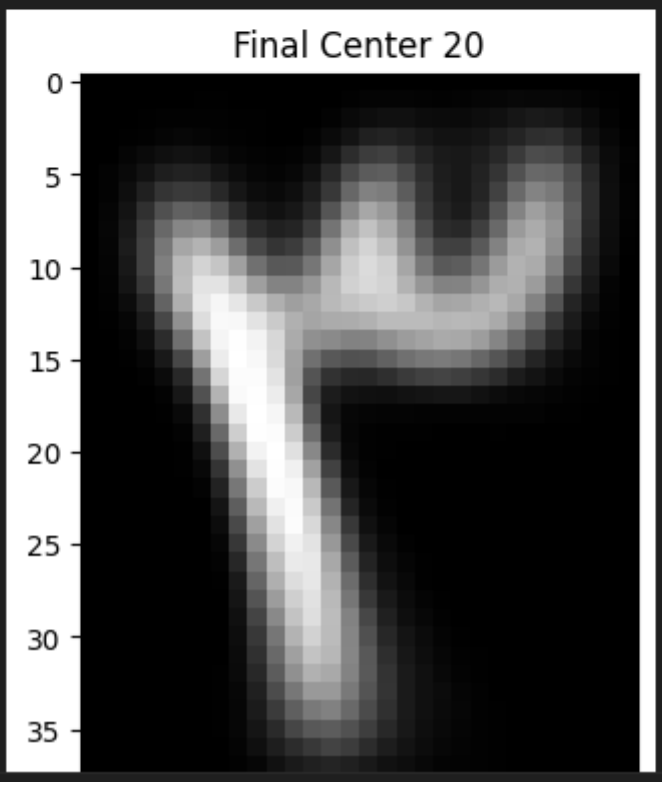
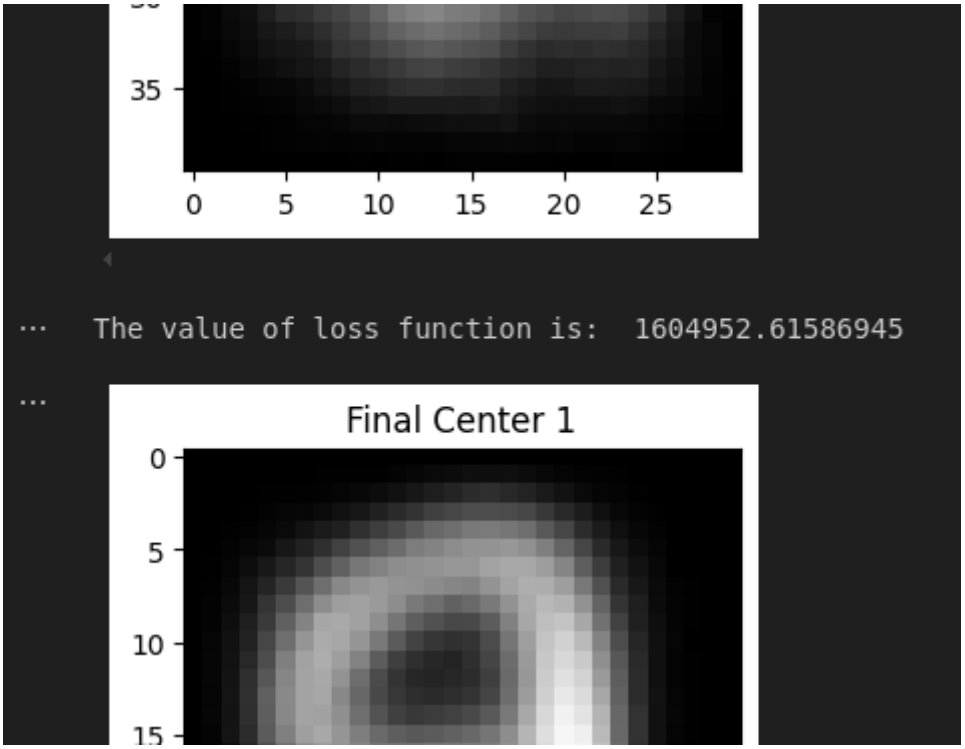

Final Center 20
0
5
10
15
20
25
30
35

مقدار تابع هزینه



تحلیل

از این دو قسمت نتیجه میگیریم که انتخاب مناسب شاخص اولیه میتواند منجر به به دست آوردن شاخص های نهایی مناسب تر و دقیق تر و خوشه بندی بهتر شود ولی تفاوت زیادی در میزان تابع هزینه ایجاد نمی کند
اگر تعداد خوشه ها را زیاد کنیم میزان تابع هزینه کم می شود که طبیعی است در این مورد برای بعضی از اعداد چند خوشه در نظر گرفته شود

در کذ برای خواندن داده ها از توابعی کتابخانه پانداس و برای کار با آرایه ها از کتابخانه نامپای هم چنین از الگوریتم خوشه بندی کتابخانه سایکیت لرن استفاده شده است

c:

Data value	a.I	a.II	a.III	a.IV	b.I	b.II	b.III
0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	2	2
4	4	3	4	4	4	3	4
4	4	8	8	4	4	8	3
5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5
6	2	2	3	6	6	6	6
6	9	9	9	9	9	9	9
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9

در کل به نظر میرسد استفاده از شاخص های اولیه که به صورت رندوم ساخته شدند دقت خوبی دارد و دقت آن در بعضی موارد نسبت به استفاده از میانگین و انتخاب رندوم از بین داده ها بهتر است هم چنین در کل در مواردی که تعداد خوشه ها ۲۰ تاست دقت کمی بیشتر است

دستورات و توابع استفاده شده

pandas: read_csv() for reading data from .txt file

matplotlib.pyplot: imshow() , title(), show() for displaying an image

numpy: np.random.randint() , np.random.choice for generating or selecting random items
reshape() , np.array_split() for working with arrays

sklearn.cluster: Kmeans , Kmeans.fit() , Kmeans.predict() ,
Kmeans.inertia_ ,Kmeans.cluster_centers_ for clustering